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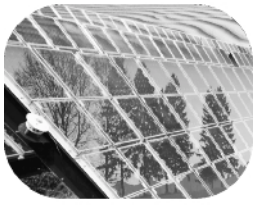
Pollution Charges, Fees, Taxes

Deposit-Refund Systems

Trading Programs



Subsidies for Pollution Control

Liability Approaches

Information Disclosure

Voluntary Programs

The United States Experience with Economic Incentives for Protecting the Environment

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EXECUTIVE SUMMARY

I. Purpose of This Report

Over its 30-year history the predominant tool used by the U.S. Environmental Protection Agency (EPA) to help achieve the nation's environmental goals has been uniform, nationally applicable regulations derived from environmental law. Those regulations, e.g., source-specific emissions limits, product specifications, and pollution-control guidelines, have been responsible for much of the improvement in air and water quality that is evident in the country today.

But over the past 20 years, and during the past decade in particular, EPA has begun to use a much broader array of tools to manage environmental quality. Among these relatively new tools, several kinds of economic incentives are being applied more and more widely. Once considered an academic abstraction or a revenue-raising adjunct to traditional regulatory mechanisms, market-based economic incentives are being used now as the principal instrument for controlling a growing number of environmental problems. To varying degrees, federal, state, and local governments are promoting the use of economic incentives as an environmental management tool because of the perceived advantages and effectiveness of these incentives.

Because of the wide—and growing—use of economic incentives at all levels of government in the United States, it is important to understand them more clearly. For example, what kinds of economic incentives are being used today to address what kinds of problems? Are particular incentives better suited for use at specific levels of government? Even more important are questions regarding relative effectiveness. How well have economic incentives performed in terms of improving environmental quality? How economically efficient and cost-effective have they been? To what extent have they stimulated technological change and innovation? How can past experience with economic incentives help improve their use today and in the future?

This report attempts to answer those questions by providing a broad overview and analysis of the current use of economic incentives as an environmental management tool in the United States. To that end, it makes use of, and builds on, related reports, surveys, and research. This report expands and updates the information contained in an earlier EPA report (1992) and a report to EPA in 1997 that documented the growing use of economic incentives in the United States and foreign countries. It also notes related research by the National Academy of Public Administration (NAPA).

At the same time, this report is not exhaustive. It does attempt to identify most of the incentives currently in use at the federal level for environmental pollution control. However, it limits its discussion of incentives at other levels of government to a representative sample of programs. A complete survey and assessment of the large number of incentives currently in use at the state and local levels would require a much broader study than this report. Likewise, the report only briefly summarizes a voluminous theoretical and applied literature on economic incentives.


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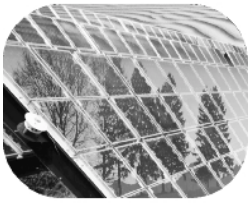
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Liability Approaches

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II. Definition of Economic Incentives

For the purposes of this report, economic incentives are defined broadly as instruments that use financial means to motivate polluters to reduce the health and environmental risks posed by their facilities, processes, or products. These incentives provide monetary and near-monetary rewards for polluting less and impose costs of various types for polluting more, thus supplying the necessary motivation to polluters. This approach provides an opportunity to address sources of pollution that are not easily controlled with traditional forms of regulation as well as providing a reason for polluters to improve upon existing regulatory requirements. Under traditional regulatory approaches, polluters have little or no incentive to cut emissions further or to make their products less harmful once they have satisfied the regulatory requirements.

The definition of economic incentives used here is quite broad. As such, a great many instruments and programs could be included in this review. By necessity the report focuses on the most significant federal programs and a representative sampling of activities at the state and local level.

III. Value of Economic Incentives

Economic incentives have a singular advantage over traditional forms of regulation: they harness the force of the marketplace to reduce environmental and health risks. While this feature does not make economic incentives applicable to every source of pollution, market forces often can operate where traditional regulations would be ineffective. Sources of pollution include point sources such as discharge pipes and stacks; area sources such as factories and storage areas; and non-point sources such as streets, farms, and forests. In a traditional regulatory system, owners of many of these sources have an incentive to comply—i.e., avoidance of enforcement actions—but *releasing* pollution has no economic cost to the owner. Consequently, owners of these sources of pollution (hereafter referred to as "sources") normally have no incentive to do more than the regulations require, whether it is a limit on emissions or on the use of a specific technology.

With market incentives, sources of pollution can see an economic value in reducing pollution because doing so saves them money. Consequently, the difference between a traditional regulatory system and economic incentives can lead to several public health, environmental, and economic benefits.

First, economic incentives in some circumstances can be structured to achieve larger reductions in pollution than would result from traditional regulations. For example, a program that allows trading of pollution reduction obligations among sources may be able to require greater reductions in pollution than a similar program that does not use trading. Pollution charges or voluntary pollution prevention programs could encourage sources to reduce emissions below permitted amounts.

Second, economic incentives often can control pollution at lower costs than can traditional regulations. By setting standardized emissions, product, or technology requirements, traditional regulations do not usually take into consideration the different costs of compliance faced by different sources. But in an incentive system, the marginal costs of controlling pollution play an essential role. When emission allowances or credits can be bought and sold by the sources, the sources that have relatively low costs of pollution control will reduce more pollution than sources that have relatively high costs of pollution control. Thus, when economic incentives are

used, goals of reducing pollution—whether applied over a facility, an industry, or the nation as a whole—will be achieved at the lowest cost as determined by market forces. One study done for the EPA (Anderson. 1999) estimated that the potential savings from widespread use of economic incentives at the federal, state, and local level could be almost one-fourth of the approximately $200 billion per year currently spent on environment pollution control in the United States.

Third, the use of economic incentives, in contrast to that of traditional regulations, can control the pollution that is caused by a multitude of small and dispersed sources. A traditional regulatory system, which relies on reporting, inspections, and fines for noncompliance, becomes very cumbersome and expensive to administer when applied to thousands, or even millions, of sources. For many serious environmental concerns today, such as surface water quality and global warming, the sources of the problem can indeed number in the millions. Deposits on lead-acid batteries and variable charges for solid waste disposal are two good examples of how economic incentives can more effectively manage the quantity of pollution that is released from large numbers of small and dispersed sources.

Fourth, economic incentives can stimulate technological improvements and innovations in pollution control in situations where traditional regulatory mechanisms may not. In some cases, traditional regulatory mechanisms can stimulate technological change. For example, challenging numerical performance standards have prompted the development of cleaner technologies (e.g., catalytic converters). Also, when regulations require the use of the best available control technology (BACT), manufacturers of pollution control equipment have an incentive to improve the performance of the products they offer for sale. But traditional regulations that specify the approved pollution control technologies discourage sources from developing better pollution control technologies. Not only is there uncertainty that an improved pollution control technology would be approved, but greater pollution control normally is costly. What source would want to engage in greater control of pollution than is required by existing regulations? Economic incentives, on the other hand, attach a value to controlling pollution. In some cases the value is an explicit monetary amount, while in other cases the financial impact is indirect. Therefore, sources have an incentive to develop technologies that are more effective or less costly, particularly when pollution reduction obligations can be traded among sources like any other commodity in the marketplace.

Clearly, economic incentives have several advantages that make them attractive environmental management tools. When properly designed and used in appropriate circumstances, they can achieve environmental results beyond those of traditional regulations, they can achieve those results at lower costs, they often can do a better job of controlling large numbers of small sources, and they provide a valuable spur to technological innovation.

However, just as economic incentives have advantages, they also have limitations. One of the most significant disadvantages is that they are often inappropriate for dealing with environmental issues that revolve around equity concerns. Many types of environmental standards are designed to protect individuals around the site of a polluting facility; in some cases the specific purpose is to protect individuals exposed to the highest pollutant concentrations. In general, people are not willing to accept higher risks to their health because it is “more economical” to reduce risks to others. There are many such environmental and health standards, including toxicity standards for air, waste management standards, and cleanup standards. For example, risks cannot be traded between Superfund sites. To do so would mean that some people would live near an unsafe site

that doesn't meet federal standards because other people would live near another site that is twice as safe as required by federal standards.

IV. Types of Economic Incentives

This report examines several types of economic incentives that are currently in use in the United States at all levels of government, and it assesses their advantages and disadvantages. Although all these incentives give sources of pollution an impetus to minimize their emissions, the incentives take widely differing forms. In fact, the variety of economic incentives in use today is one of the most remarkable developments in environmental management over the past decade.

1. Fees, Charges, and Taxes

From the perspective of sources that are subject to environmental fees, charges, and taxes, these three terms are largely interchangeable in terms of their effects. They all require that the generator of a designated type of pollution pay a fee (or charge or tax) for each unit of pollution. These fees make attractive tools for managing the environment because they attach an explicit cost to polluting activities and because sources can easily quantify their savings if they reduce the amount of pollution they emit. One disadvantage is that fees do not guarantee the amount by which a source would reduce pollution.

Pollution-related fees, charges, and taxes are widely collected at all levels of government, and they are one of the most prevalent economic incentives in use today. For example, fees linked to air emissions are imposed in California, Texas, and several other states, while permit fees for water effluent discharge are based on the volume and toxicity of the discharge in Washington, New Jersey, and Wisconsin, among others. Per-bag fees on households that dispose of solid waste are in effect in more than 3,000 communities across the country. Fees that are tied to resources such as the use of grazing lands, water, and sewage systems are widely levied in the United States.

Similarly, environmental taxes are usually imposed on landfill operations and the disposal of hazardous wastes. Product charges are sometimes levied on products—e.g., chlorofluorocarbons, low-efficiency automobiles, fertilizer, motor oil, and packaging—that are believed to have harmful effects on the environment. Other fees are being charged on activities that are potentially damaging to the environment, for example, wetlands development and storm water runoff.

Although fees can generate substantial revenues for the government agency that imposes them, they tend to be set at rates too low to have a significant impact on pollution. Generally speaking, if pollution fees or taxes were set at rates equal to the incremental damage being caused by the pollution, or at a level that would force changes in business or personal behavior, they would be controversial. Concerns about the competitiveness of U.S. businesses would be raised if foreign companies were not subject to similar fees. Consequently, the rates of most of these environmental fees and taxes are not set high enough to achieve U.S. environmental goals, although in some specific cases fees and taxes are working well as a mechanism for controlling pollution.

2. Deposit-Refund Systems

Deposit-refund systems require a monetary deposit at the time of sale of a product. The deposit is returned when the item is returned at the end of its useful life. In the United States, deposit-

refund systems have been applied most widely to help control the disposal of lead-acid batteries, but they also are being applied in some states to products such as aluminum and glass cans, pesticide containers, and tires. When used products are valuable, as is currently the case for lead-acid batteries, the private sector often creates and manages a disposal system. Regardless of who manages the disposal of such products, the fees charged by this system help subsidize the return of recyclable products.

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

3. Marketable Permits

There are two distinct types of trading systems: cap-and-trade systems and credit systems. Cap-and-trade systems seek a specific environmental result; trading allowances to release pollution is simply an option to minimize the cost of achieving the emission reductions specified in the regulatory cap on emissions. In the cap-and-trade approach, allowances for future emissions are sold or granted to existing sources. Uncapped credit systems, on the other hand, do not establish any fixed ceiling on total emissions. Total emissions can increase if new sources of pollution enter the market and as existing sources increase production. In uncapped systems, credits are earned for controlling pollution beyond a baseline specified in one's permit. Distinctions between cap-and-trade and credit systems are discussed in much more detail in chapter 6.Two well-known examples of cap-and-trade systems are EPA’s Acid Rain Trading Program and Southern California's RECLAIM. A wide variety of other federal, state and local programs feature some form of emission or effluent trading. For example, some of the high-mountain communities in Colorado require permits to use wood-burning appliances. Existing homeowners are given permits reflecting historic use but those who wish to install a new wood stove in a home are required to retire two existing permits, a rule that helps reduce air pollution. Certain classes of heavy-duty engines are subject to emissions averaging to meet an average performance standard, which is just the trading of pollution control obligations within a company, as well as emissions trading between companies. The rights to burn dry grass are subject to trading in Spokane County, Washington, and land development rights are traded in a few jurisdictions in Maryland, New Jersey, and Florida. In some areas, wetland mitigation credits can be created, banked, and sold to offset the adverse effects of development.

Trading programs have certain features that have made them increasingly popular in the United States. In a trading program, capital moves between companies involved in trades, and innovative, entrepreneurial companies can profit from low-cost reductions in emissions. In addition, cap-and-trade programs can provide great certainty about the magnitude of environmental improvement that will be achieved.

At the same time, trading programs may have several drawbacks, including the potential for high transaction costs and inactive markets, especially in credit or open-market systems. High costs can be attributed to the need to verify each reduction before authorizing the credit. Clearly, trading programs should not be applied to all environmental problems. The long-term effects of

trading programs on technical innovation vary from program to program. Some have spurred considerable innovation, such as the acid rain program, while others have not due to high transaction costs.

4. Subsidies

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

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

5. Liability

Being held legally responsible for health or environmental damages is a potent incentive for sources to reduce or avoid pollution, since if found liable they can face extraordinarily large and unpredictable damage claims. The Clean Water Act, for example, requires the cleanup of oil and petroleum products spilled into the nation's waters, while the Superfund Act and the Oil Pollution Act impose liability for environmental damages caused by the release of hazardous substances and oil, respectively. Since 1990, awards and settlements for damages to natural resources under these and related state statutes total more than $700 million, with a number of cases that involve large sums still in varying stages of litigation. Liabilities associated with the cost of cleanup at Superfund sites total billions of dollars.

With potential costs of this magnitude, sources have a powerful incentive to minimize their legal exposure. Consequently, expensive technologies that control pollution or aggressive environmental management systems can seem very reasonable to sources. While liability has prodded sources to take significant actions to reduce pollution, such as managing hazardous wastes on site, it is sometimes difficult to quantify the environmental results of those actions or to establish a causal link between concerns over liability and reductions in pollution.

6. Information Disclosure

The collection and public availability of information on environmental performance has proven to be a strong incentive for sources to reduce their emissions of pollution. The incentive derives from a number of factors. For example, when companies collect emissions information, they learn about the nature and magnitude of their emissions. When such information is made easily accessible to the public, workers and local communities have a much better idea of the environmental risks they face, so they are more prone to support or demand actions to reduce emissions. When a source's emissions are shown to decline over time, the source often reaps the benefits of better relationships with its employees and with the local community. Finally, in

some cases a proven, long-term record of environmental stewardship makes a company's products more desirable to consumers.

The disclosure of environmental performance information is much more common today than a decade ago. Although some information is disclosed voluntarily, other information must be released to the public as required by statute. The two best-known laws mandating the public disclosure of environmental information are the Toxics Release Inventory provisions of the federal Community Right-to-Know Act and California's Proposition 65. Other forms of information reporting include environmental impact assessments, product labeling, environmental performance awards, Securities and Exchange Commission (SEC) environmental reporting requirements, and disclosure requirements for lead paint and radon when homes are sold.

Information disclosure has been a powerful tool for reducing pollution. Over the past decade, the Toxics Release Inventory, for example, shows that sources have substantially reduced the amount of substances listed in the inventory that they release into the environment. Because the TRI requires only the reporting of information, actions taken by sources to reduce pollution are voluntary and in all likelihood relatively low cost.

7. Voluntary Actions

Although government programs that encourage sources to reduce pollution on a voluntary basis were virtually unheard of 20 years ago, they have become one of the fastest growing environmental management tools in the country. At present, EPA and state governments have a variety of programs in place that encourage sources like private companies, schools, hospitals, and universities to reduce specific kinds of pollution. A 1999 EPA survey identified 54 such federal partnership programs, up from 28 just three years earlier. More than 7,000 organizations now participate in EPA's voluntary programs, and in 1998 those participants conserved 1.8 billion gallons of clean water, 7.8 million tons of solid waste, and prevented the release of air pollution in an amount equivalent to taking 13 million cars off the road. At t the same time, EPA estimates these organizations saved roughly $3.3 billion. Literally hundreds of similar programs are in operation at the state and local levels.

There are a number of reasons why voluntary reductions in pollution are proving more and more popular with sources, and they are related to the incentives associated with information disclosure. When sources voluntarily reduce pollution and their employees, neighboring communities, and customers learn about it, sources gain several benefits. Voluntary actions taken by sources often reduce employees' exposure to harmful pollutants, thus lessening sources' liability and improving their relationship with labor. Sources enjoy better relations with neighboring communities, and a reputation for good environmental stewardship may attract more customers for their products. In some cases, sources also save money by taking these actions. Moreover, sources that join voluntary partnership programs can be eligible for various kinds of technical assistance from sponsoring government agencies. For example, they can receive free information on the cost and availability of energy-efficient technologies.

V. Conclusions

1. Diversity of Economic Incentives at EPA

EPA is well known for its use of emissions trading as a key feature of its program to control acid rain. However, acid rain emissions trading is only one of the economic incentive programs managed by EPA.

Emissions trading, averaging, and banking are helping control major air pollution problems such as stratospheric ozone depletion and ozone-forming nitrogen oxide emissions. They are helping this country to achieve national goals for cleaner fuels, and they are built into virtually all EPA rules for motor vehicles and engines. New efforts to implement a Total Maximum Daily Load (TMDL) program in areas with impaired water quality are expected to substantially increase the use of water effluent trading in the years ahead.

EPA subsidies are helping to revitalize brownfields across the country. In addition, the Agency is rapidly expanding the kinds and extent of environmental information that it makes available to the public and that it requires sources of pollution to disclose to the public. The Toxic Release Inventory required by Superfund may be the public's most well known and most widely used EPA database, but over the past several years it has been augmented by many others. For example, beginning in 1998 drinking water suppliers have been required to provide households with information on the quality of their drinking water. Moreover, in 2000 EPA began publicizing the emission characteristics of motor vehicles to help consumers in their purchasing decision and to encourage vehicle manufacturers to further reduce emissions.

Voluntary programs have also become a major environmental management tool at EPA over the past decade. The Agency now manages dozens of such programs, many of which have led to measurable reductions in pollutant emissions. In some cases EPA's voluntary programs have given U.S. companies an incentive to develop less polluting products, like computers and household appliances, the sale of which reduces pollution in every part of the country.

EPA has incorporated nearly every type of economic incentive currently in use in the United States into its programs. And the growth of those incentives over the past decade suggests that the Agency is likely to increase its use of them in the decade ahead.

2. Wide Application at Other Levels of Government

The survey undertaken in this report demonstrates the extent to which economic incentives have been adopted as an environmental management tool at state and local levels in the United States. The report discusses dozens of such applications in detail, but there are hundreds more that are known but not included for analysis here.

Not only are the number of state and local economic incentives growing, but their diversity is remarkable. In fact, one of the most interesting aspects of economic incentives that are being tested in different states and communities in the 1990s is their rich variety. Several examples follow. Communities in California, Washington, Michigan, Wisconsin, Minnesota and many other states are charging fees to households for collecting and disposing of their solid waste based on the amount of waste generated. More and more states are imposing taxes on the generation of hazardous wastes. North Carolina imposed a disposal fee on "white goods" such as refrigerators and freezers in 1995, the same year that Minnesota levied a tax on the

"contamination value" of property. As an outgrowth of EPA's proposed Open Market Trading Rule, states like Illinois, Michigan, New Jersey, Texas, and Pennsylvania have developed trading programs for air emissions. In addition to EPA's subsidies for developing brownfields, states like New Jersey, Pennsylvania, Delaware, Minnesota, Ohio, Arizona, and Tennessee are offering similar subsidies. In addition, trading programs for water effluent are in various stages of development in Long Island Sound, the Boise River, Chesapeake Bay and many other locations.

The sheer numbers and variety of these programs make them a difficult topic for analysis within a single limited study. However, they do suggest that state and local governments will continue to be a major developer and user of economic incentives well into the future.

3. Unique Contributions to Environmental Management

In some instances it is difficult to quantify the reductions in pollutants or the improvements in human health and environmental quality that result from the use of specific economic incentives. However, there is little doubt that such incentives are providing a new and unique element to environmental management in the United States. In many cases, incentives are generating health and environmental benefits beyond what is possible with traditional regulations, and sometimes they can be applied in situations where regulations might not be possible at all. It is difficult to imagine, for example, the public supporting a regulatory system that mandated reductions in household waste, but household wastes are declining significantly in communities that charge for waste collection based on the amount generated.

The contributions to environmental management made by economic incentives are as varied as the incentives themselves. Deposit-refund systems are helping change the environmental behavior of individual consumers in ways that traditional regulations could not. Deposit-refund systems and taxes on products and outputs are reducing the pollution caused by a multitude of small and geographically dispersed sources that typically are difficult to control through traditional regulations.

Many economic incentives give an impetus to technological change and innovative pollution control because sources can generate profits by finding better, cheaper ways of reducing emissions. EPA's voluntary programs are a particularly good example of economic incentives acting as an incubator for technological improvements. When businesses take initiative on their own or work collaboratively with government to find ways to reduce pollution, instead of merely reacting to government regulations, they tend to apply the same inventiveness and cost-cutting skills used in other parts of the business. In this sense, voluntary programs, as well as other kinds of economic incentives, unleash the qualities of American entrepreneurs that make U.S. businesses such strong competitors in the marketplace and encourage these sources to use those skills to protect the environment.

4. Cost Savings

Economists have long understood that economic incentives have the potential to reduce pollution at a cost below that imposed by traditional regulations. The national experience of using economic incentives over the past decade reinforces this point of view. In some cases, it is difficult to quantify the costs imposed by a particular incentive. In other cases, the hoped-for cost reductions do not materialize to the extent expected. However, in general, it is clear that economic incentives do provide the opportunity to achieve any given level of pollution control with substantial cost savings.

Evidence supporting the lower costs of economic incentives is both theoretical (derived from models) and empirical (based on the results of operating programs). At least 40 studies based on computer modeling of different scenarios for controlling pollution show that economic incentives should be more cost-effective than traditional regulations. One study (ICF, 1989) estimated that allowance trading in EPA's acid rain program could result in savings to affected utilities of $700 to $800 million per year over the long term. The actual cost savings now are believed to be at least twice this amount. Other areas also offer potentially large savings. For example, effluent trading has the potential to save sources as much as $7.5 billion annually. Even if the cost savings from using market incentives are less than predicted as a result of regulatory, institutional, transactional, or legal restraints, or some combination of these factors, the actual savings undoubtedly are still significant.

5. Applicability to Specific Environmental Problems

The nation's recent—and growing—experience with economic incentives has helped improve our collective understanding of their relative usefulness and applicability to specific environmental problems. Experience to date suggests that, even though a wide variety of incentives are available, any particular one may be effective in managing only a fairly narrow range of problems (see Table ES-1).

Product taxes, for example, have been imposed on such diverse goods as fertilizer, tires, and chlorofluorocarbons. It is most useful to apply these taxes to products that have many consumers because administering these taxes is relatively simple and inexpensive. Product taxes have the added advantage of raising revenue for the taxing authority. For other environmental problems, however, raising revenue may be a less important, or even inconsequential, consideration.

Subsidies often are politically popular. In contrast to taxes, they transfer funds to specific targets within the private sector where incentives for conservation, recycling or pollution control currently are lacking. Consequently, subsidies may be most useful in situations in which targeted assistance is essential and other policy approaches would be politically unacceptable or ineffective.

Deposit-refund systems, like input or output taxes, appear to be most useful when applied to numerous, decentralized sources of pollution. However, these systems tend to have high administrative costs compared to alternative instruments such as taxes and fees. Clearly, the relative ability to administer the incentive would be a primary consideration when choosing among these alternatives.

In short, any government agency interested in using economic incentives has a range of options from which to choose. The environmental success of the incentive selected depends to a great extent on the characteristics of the specific environmental problem at hand.

Table ES-1. Uses of Economic Incentives

Incentive	Examples	Pros & Cons
Pollution Charges & Taxes	Emission charges Effluent charges Solid waste charges Sewage charges	Pros: stimulates new technology; useful when damage per unit of pollution varies little with the quantity of pollution Cons: potentially large distributional effects; uncertain environmental effects; generally requires monitoring data
Input or Output Taxes & Charges	Leaded gasoline tax Carbon tax Fertilizer tax Pesticide tax Virgin material tax Water user charges CFC taxes	Pros: administratively simple; does not require monitoring data; raises revenue; effective when sources are numerous and damage per unit of pollution varies little with the quantity of pollution Cons: often weak link to pollution; uncertain environmental effects
Subsidies	Municipal sewage plants Land use by farmers Industrial pollution	Pros: politically popular, targets specific activities Cons: financial impact on government budgets; may stimulate too much activity; uncertain effects
Deposit-Refund Systems	Lead-acid batteries Beverage containers Automobile bodies	Pros: deters littering; stimulates recycling Cons: potentially high transaction costs; product must be reusable or recyclable
Marketable Permits	Emissions Effluents Fisheries access	Pros: provides limits to pollution; effective when damage per unit of pollution varies with the amount of pollution; provides stimulus to technological change Cons: potentially high transaction costs; requires variation in marginal control costs
Reporting Requirements	Proposition 65 SARA Title III	Pros: flexible, low cost Cons: impacts may be hard to predict; applicable only when damage per unit of pollution does not depend on the quantity of pollution
Liability	Natural resource damage assessment Nuisance, trespass	Pros: provides strong incentive Cons: assessment and litigation costs can be high; burden of proof large; few applications
Voluntary Programs	Project XL 33/50 Energy Star	Pros: low cost; flexible; many possible applications; way to test new approaches Cons: uncertain participation

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Table of Contents

List of Figures

List of Tables

List of Acronyms

ADF	Advance Disposal Fee
AEL	Acceptable Exposure Level
AF	Alternative Fuel
AFV	Alternative Fuel Vehicle
API	American Petroleum Institute
AQMP	Air Quality Management Plan
ATU	Allotment Trading Units
AUM	Animal Unit Months
BAAQMD	Bay Area Air Quality Management District
BAT	Best Available Technology Economically Achievable
BCRP	Beverage Container Recycling Program
BLM	Bureau of Land Management
BOD	Biochemical Oxygen Demand
BPT	Best Practicable Control Technology Currently Available
Btu	British Thermal Unit
CAA	Clean Air Act
CAFE	Corporate Average Fuel Economy
CalCAP	California Capital Access Program
CARB	California Air Resources Board
CBEP	Community-Based Environmental Protection
CCAP	Climate Change Action Plan
CCTI	Climate Change Technology Initiative
CDM	Clean Development Mechanism
CEM	Continuous Emission Monitoring
CEQ	Council on Environmental Quality
CERCLA	Comprehensive Environmental Response Compensation and Liability Act
CFC	Chlorofluorocarbon
CH_4	Methane
CLEAN	California Loans for Environmental Assistance Now
CLI	Consumer Labeling Initiative
CMA	Chemical Manufacturers Association
CNG	Compressed Natural Gas
CO_2	Carbon Dioxide
CPCFA	California Pollution Control Financing Authority
CPTC	California Private Transportation Company
CRP	Conservation Reserve Program
CRS	Congressional Research Service
CSI	Common Sense Initiative
CWA	Clean Water Act
DACS	Department of Agriculture and Community Services (Florida)
DEM	Division of Environmental Management
DfE	Design for the Environment
DOE	Department of Energy
DOT	Department of Transportation
EAP	Environmental Accounting Project
EBI	Environmental Benefits Index
EER	Energy Efficiency Rating
EHS	Environmental Health and Safety
EIP	Economic Incentive Program

ELP	Environmental Leadership Program
EO	Executive Order
EPA	Environmental Protection Agency
EPCA	Energy Policy and Conservation Act
EPCRA	Emergency Planning and Community Right-to-Know Act
EQIP	Environmental Quality Incentive Program
ERC	Emission (or Effluent) Reduction Credits
ERMS	Emission Reduction Market System
EU	European Union
FGD	Flue Gas Desulfurization
FTC	Federal Trade Commission
FWPCA	Federal Water Pollution Control Act
FY	Fiscal Year
GEF	Global Environment Facility
GHG	Greenhouse Gas
GNP	Gross National Product
gpm	Grams Per Mile
HAP	Hazardous Air Pollutant
HEL	Highly Erodible Land
HFC	Hydrofluorocarbon
HON	Hazardous Organic Chemical NESHAP
IET	International Emissions Trading
IPTEP	Industrial Property Tax Exemption Program
IRR	Internal Rate of Return
ISO	International Organization for Standardization
JI	Joint Implementation
kWh	Kilowatt Hour
LAER	Lowest Achievable Emission Rate
MACT	Maximum Available Control Technology
MMBtu	Million Btus
MMTCE	Million Metric Tons of Carbon-Equivalent
MOU	Memorandum of Understanding
mpg	Miles Per Gallon
MSDS	Material Safety Data Sheet
N_2O	Nitrogen Oxide
NEPA	National Environmental Policy Act
NESHAP	National Emission Standards for Hazardous Air Pollutants
NFRC	National Fenestration Rating Council
NGO	Nongovernmental Organization
NLEV	National Low Emission Vehicle
NMOG	Non-Methane Organic Gas
NOAA	National Oceanic and Atmospheric Administration
NO_x	Nitrogen Oxide
NPDES	National Pollution Discharge Elimination System
NRDC	Natural Resources Defense Council
NSR	New Source Review
ODC	Ozone-Depleting Chemical
OMB	Office of Management and Budget
OPA	Oil Pollution Act
OSHA	Occupational Safety and Health Administration
OTC	Ozone Transport Commission
P2	Pollution Prevention

P3	Public-Private Partnership
PAH	Poly-Nuclear Aromatic Hydrocarbons
PDR	Purchase of Development Rights
PET	Polyethylene Terephthalate
PFC	Perfluorocarbon
POTW	Publicly Owned Treatment Work
ppm	Parts Per Million
PRIA	Public Rangelands Improvement Act
PSD	Prevention of Significant Deterioration
RACT	Reasonably Available Control Technology
RCRA	Resource Conservation and Recovery Act
RECLAIM	Regional Clean Air Incentives Market
RIA	Regulatory Impact Analysis
RFF	Resources for the Future
ROG	Reactive Organic Gases
RTC	RECLAIM Trading Credits
RVP	Reid Vapor Pressure
SARA	Superfund Amendments and Reauthorization Act
SCAQMD	South Coast Air Quality Management District
SCS	Scientific Certification Systems
SEC	Securities and Exchange Commission
SEP	Supplemental Environmental Project
SF_6	Sulfur Hexafluoride
SFI	Sustainable Forestry Initiative
SIC	Standard Industrial Classification
SIP	State Implementation Plan
SMCRA	Surface Mining Control and Reclamation Act
SOCMI	Synthetic Organic Chemical Manufacturing Industry
SO_2	Sulfur Dioxide
SRF	State Revolving Fund (Clean Water)
STEP	Strategies for Today's Environmental Partnership (API)
TSCA	Toxic Substances Control Act
TDR	Transferable Development Rights
TMDL	Total Maximum Daily Load
TNRCC	Texas Natural Resource Conservation Commission
TRI	Toxics Release Inventory
TSP	Total Suspended Particulates
UNFCCC	United Nations Framework Convention on Climate Change
URVs	Unit Risk Values
USAID	United States Agency for International Development
USDA	United States Department of Agriculture
USIJI	United States Initiative on Joint Implementation
VMT	Vehicle Miles Traveled
VOCs	Volatile Organic Compounds
VOM	Volatile Organic Matter
WAVE	Water Alliance for Voluntary Efficiency
WRAP	Waste Reduction Awards Program
WRP	Wetlands Reserve Program
WRI	World Resources Institute