The Next Generation of Market-Based Environmental Policies

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Abstract

We examine what will be required if market-based environmental policy instruments are to become a major force in U.S. environmental policy. We define market-based instruments, and specify five categories: pollution charges; tradable permits; deposit refund systems; reducing market barriers; and eliminating government subsidies. We review major U.S. applications, including: EPA's emissions trading program; the leaded gasoline phasedown; water quality permit trading; CFC trading; SO_2 allowance trading; and the RECLAIM program. We assess the U.S. experience in terms of the relatively limited use of these instruments and in terms of the mixed record of performance of implemented instruments. We ask how the next generation of market-based instruments can be advanced, focusing on four sets of approaches: improving program design; applying market-based instruments on the state level; implementing new Federal programs; and addressing long-term issues. We conclude with a brief prognosis of the likely future role of market-based instruments in U.S. environmental policy.

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INTRODUCTION

The next generation of environmental policy will require the use of innovative tools and strategies to meet present and future challenges. Market-based instruments are one such tool. These instruments are by no means a new policy idea. Indeed, over the past two decades they have held varying degrees of prominence on the environmental policy landscape, due, in part, to the fact that they are an attractive policy instrument in both theory and practice. But market-based instruments have failed to meet the great expectations that have often been set for them. They are currently only on the peripheries of environmental policy and, when they have been implemented, they frequently have not performed as predicted. Does this represent yet another breakdown between policy theory and policy practice? Was the effort to transform environmental regulations with these tools nothing more than quixotic tilting at windmills and is it time to return to more established – if expensive – policy mechanisms?

We believe the answer is no. Market-based instruments have delivered attractive results where implemented and promise additional benefits. To date, their effectiveness has been undermined by unrealistic expectations, lack of political will, design flaws, and limitations in company skills. These are all remediable and we may at least be approaching the steep part of the learning curve.

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Thus, rather than abandoning the use of market-based instruments, we believe that policy makers on all levels should direct their efforts to making the next generation of market-based instruments work better than those that came before. By examining the use of market-based instruments, and by highlighting some of their flaws to date, we hope to identify some of the ingredients required for these instruments to become a fundamental and effective part of the next generation of environmental policy.

In Part 1, we explain, for the newcomer, what market-based instruments are and set forth the basic theory behind their use. In Part 2, we review those instruments that have been implemented, and assess why their use has been limited and their performance less than predicted. Part 2 also reviews what has been happening on the front lines in firms' approaches to these instruments. In Part 3, we argue that policy makers' energies should be increasingly devoted to developing a next generation of market-based instruments, and we offer some guidance for that effort.

1. WHAT ARE MARKET-BASED ENVIRONMENTAL POLICY INSTRUMENTS?

There are two steps leading to the formulation of environmental policy: the choice of an overall goal and the selection of a means to achieve that goal. In practice, these two steps are often linked within the political process, because both the choice of a goal, and the mechanism for achieving that goal, have important political ramifications.[1] In this chapter, however, we focus exclusively on the second step. We assess the use of market-based policy instruments to reach given environmental goals.

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[1] While discussion of goals typically precedes examination of alternative means for achieving goals, this is not necessarily the case. For example, both the Bush and Clinton administrations endorsed cost-effective, market-based methods for addressing global climate change before either had committed itself to specific greenhouse policy goals.

1.1 A Definition of Market Incentives

Market-based instruments are regulations that encourage behavior through price signals rather than through explicit instructions on pollution control levels or methods. These policy instruments, such as tradable permits or pollution charges, are often described as “harnessing market forces” because if they are properly implemented, they encourage firms, through economic incentives, to undertake pollution control efforts that both are in their financial self-interest and that will collectively meet policy goals.[2]

While this chapter focuses on several types of market-based instruments which fall within our definition, it is certainly possible to take a broader view of incentive programs. Indeed, some of the most notable policy initiatives of the last several years have been at the broader level.

For example, many regulations have been promulgated at all levels of government that simply require increased information reporting.[3] Perhaps the most notable of these is the Toxic Release Inventory which requires companies to publicly report plant emissions of 649 compounds. Although no regulation states that a plant must reduce these emissions, firms may choose to do so in light of consumer or community pressure. In fact, TRI emissions have declined 44 percent since the low was established in 1987.[4]

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[2] See: Stavins, Robert N., ed. *Project 88 - Round II Incentives for Action: Designing Market-Based Environmental Strategies.* Washington, D.C., May 1991; and Stavins, Robert N., ed. *Project 88: Harnessing Market Forces to Protect Our Environment.* Washington, D.C., December 1988. Both studies were sponsored by Senator Timothy E. Wirth, Colorado, and Senator John Heinz, Pennsylvania.

[3] For example, the World Environment Policy Act of 1989 required that any container or product containing ozone depleting substances be labeled to indicate that the substance harms public health and environment by destroying ozone and disrupting the climate.

[4] See: *1994 Toxic Release Inventory: Public Data Release*. EPA: Washington, D.C., Jan. 1996.

1.2 Command-and-Control Approaches

Conventional approaches to regulating the environment are traditionally referred to as "command-and-control" regulations since they allow relatively little flexibility in the means of achieving goals. Early environmental policies, such as the Clean Air Act of 1970 and the Clean Water Act of 1972, relied almost exclusively on these approaches.[5]

In general, command-and-control regulations force firms to shoulder identical shares of the pollution-control burden, regardless of the relative costs to them of this burden. Command-and-control regulations do this by setting uniform standards for firms, the most prevalent of which are technology-based and performance-based standards. Technology-based standards specify the method, and sometimes the actual equipment, that firms must use to comply with a particular regulation. For example, all electric utilities might be required to employ a specific type of scrubber to remove particulates. A performance standard sets a uniform control target for firms, while allowing some latitude in how this target is met. For example, a regulation might limit the number of allowable units of a pollutant released in a given time period, but might not dictate the means by which this is achieved.

Holding all firms to the same target can be expensive and, in some circumstances, counterproductive. While standards can effectively limit emissions of pollutants, they typically exact relatively high societal costs in the process, by forcing firms to resort to unduly expensive means of controlling pollution.[6] Because the costs of controlling emissions may

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[5] For a more detailed case-by-case description of the use of command-and-control instruments see Portney, P.R., ed. *Public Policies for Environmental Protection.* Resources for the Future: Washington, D.C., 1990.

[6] For example, one survey of eight empirical studies of air pollution control found that the ratio of actual, aggregate costs of the conventional, command-and-control approach to the aggregate costs of least-cost

vary greatly between firms, and even within the same firm, the appropriate technology in one situation may be inappropriate in another.

Furthermore, command-and-control regulations tend to freeze the development of technologies that might otherwise result in greater levels of control. Little or no financial incentive exists for businesses to exceed their control targets, and both technology-based and performance-based standards discourage experimentation with new technologies. A business experimenting with a new technology may be "rewarded" by being held to a higher standard of performance, but is not given the opportunity to benefit financially from its investment, except to the extent its competitors have even more difficulty reaching the new standard.

1.3 Characteristics of Market-Based Policy Instruments

Market-based instruments have captured the attention of environmental policy makers because of the potential advantages they offer over traditional command-and-control approaches. The two most notable advantages are (i) cost effectiveness and (ii) dynamic incentives for technology innovation and diffusion.

In theory, if properly designed and implemented, market-based instruments allow any desired level of pollution cleanup to be realized at the lowest possible overall cost to society. Or, alternatively, they offer more control for the same level of resources. Market-based instruments might achieve the same aggregate level of control as command-and-control regulations, but they do so by allowing firms to more efficiently share the burden of pollution

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benchmarks ranged from 1.07 for sulfate emissions in the Los Angeles area to 22.0 for hydrocarbon emissions at all domestic DuPont plants. See Tietenberg, T. *Emissions Trading: An Exercise in Reforming Pollution Policy*. Washington, D.C.: Resources for the Future, 1985.

control. They provide incentives for the greatest reductions in pollution by those firms that can achieve these reductions most cheaply.

Market-based instruments are cost-effective because they require fewer total economic resources to achieve the same level of pollution control. Rather than equalizing pollution levels among firms (as with uniform-pollution standards), market-based instruments equalize the incremental amount that firms spend to reduce pollution (their marginal cost).[7]

Command-and-control approaches could theoretically also achieve this cost-effective solution. However, this would require that different standards be set for each pollution source, and, consequently, that policy makers obtain detailed information about the compliance costs each firm faces. Such information is simply not available to government. By contrast, market-based instruments provide for a cost-effective allocation of the pollution control burden among sources without this information. Additionally, in contrast to command-and-control regulations, market-based instruments have the potential to provide powerful incentives for companies to adopt cheaper and better pollution-control technologies.[8]

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[7] Each source's marginal costs of pollution control are the additional or incremental cost for that source to achieve an additional unit of pollution reduction. If these marginal costs of control are not equal across sources, then the same aggregate level of pollution control could be achieved at lower overall cost simply by reallocating the pollution control burden among sources, so that low-cost controllers controlled proportionately more, and high-cost controllers controlled proportionately less. Additional savings could theoretically be achieved through such reallocations until marginal costs were identical for all sources.

[8] For an empirical analysis of the dynamic incentives for technological change under different policy instruments, see Jaffe, Adam B. and Robert N. Stavins. "Dynamic Incentives of Environmental Regulations: The Effects of Alternative Policy Instruments on Technology Diffusion." *Journal of Environmental Economics and Management* 29 (1995): S-43-S-63. This paper develops a general approach for comparing the impact of policies on technology diffusion and applies it to the most frequently considered policy instruments for global climate change.

1.4 Categories of Market-Based Instruments

We can divide market-based instruments into five categories: pollution charges, tradable permits, deposit-refund systems, reductions in market barriers, and government subsidy elimination.

Pollution charge systems assess a fee or tax on the amount of pollution that a company generates rather than simply on its pollution-generating activities.[9] Consequently, it is worthwhile for a company to reduce pollution to the point at which its marginal cost of control is equal to the pollution-tax rate. By internalizing the previously external pollution costs, firms will control pollution to differing degrees, with high-cost controllers controlling less, and low-cost controllers controlling more.[10] This is not just a theoretical savings. Research indicates that control costs can vary enormously due to a firm's production design, its physical configuration, the age of its assets, etc. The end result can be substantial savings in the total cost of pollution control as compared to the cost of all firms controlling to exactly the same level. The challenge with charges is figuring out where to set the tax. Ideally, it will be where the tax equals the benefits of cleanup. However, policy makers have a difficult time knowing beforehand how firms will respond to a given level of taxation, so it is difficult to know with precision what level of cleanup will result from any given charge.

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[9] For example, a pollution charge might take the form of a charge per unit of sulfur dioxide emissions, not a charge per unit of electricity generated. The choice of whether to tax pollution quantities, activities preceding discharge, inputs to those activities, or actual damages will depend upon tradeoffs between costs of abatement, mitigation, damages, and program administration, including monitoring and enforcement.

[10] A.C. Pigou is generally credited with developing the idea of a corrective tax to discourage activities which generate externalities, such as environmental pollution. See Pigou, A. *The Economics of Welfare* 4th Ed., 1952.

Tradable permits can achieve the same cost-minimizing allocation of the pollution control burden as a charge system, while avoiding the problem of uncertain responses by firms.[11] Under a tradable permit system, an allowable overall level of pollution is established and then allotted among firms in the form of permits. Firms that keep their emission levels below the allotted level may sell or lease their surplus permits to other firms or use them to offset excess emissions in other parts of their facilities.

Under a *deposit refund system,* consumers pay a surcharge when purchasing potentially polluting products. Upon return of the product to an approved center for recycling or proper disposal, the deposit is refunded. A number of states have successfully implemented this system through "bottle bills," to control litter from beverage containers and to reduce the flow of solid waste to costly landfills.[12] This concept has also been applied to lead-acid batteries.

Reducing market barriers can also help to curb pollution. In some cases, substantial gains can be made in environmental protection simply by removing existing government-mandated barriers to market activity. For example, measures that facilitate the voluntary exchange of water rights promote more efficient allocation and use of scarce water supplies.[13]

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[11] See Hahn, Robert and Roger Noll. "Designing a Market for Tradable Permits." in *Reform of Environmental Regulation*. W. Magat edition, 1982. Much of the literature on tradable permits may actually be traced to Coase's treatment of negotiated solutions to externality problems. See generally: Coase. "The Problem of Social Cost." *Journal of Law and Economics* 1 (1960).

[12] See: Bohm, P. *Deposit-Refund Systems: Theory and Applications to Environmental, Conservation, and Consumer Policy.* 1981. Menell, "Beyond the Throwaway Society: An Incentive Approach to Regulating Municipal Solid Waste." *Ecology Law Quarterly (1990).*

[13] See: Willey and Graff. "Federal Water Policy in the United States - An Agenda for Economic and Environmental Reform." *Columbia Journal of Environmental Law* (1988): 349-351.

Elimination of government subsidies can be a powerful economic incentive for environmental protection. Subsidies are the mirror image of various taxes and, in theory, can provide important economic incentives to address environmental problems. In practice, however, many subsidies promote inefficient and environmentally unsound economic development. This market distortion received much play in the 104th Congress under the discussion of "corporate welfare." A prime example of this is the below-cost sale of timber by the U.S. Forest Service, which does not even allow for the recovery of the cost of making timber available for harvesting by private lumber companies.

2. WHERE DO WE STAND?

One of the difficulties in understanding the practical potential for market-based instruments is that the experience base upon which to glean lessons is limited. This is, in itself, an issue to which we will return later. Nonetheless, market-based instruments have had some notable uses in the United States, Europe, and the rest of the world during the last two decades. Without trying to be exhaustive, section 2.1 overviews six occasions where market-based instruments have been implemented in the United States. We examine why these instruments are still at the fringes of environmental policy, as well as why those instruments that have been implemented have not performed as predicted. Of particular focus will be firms' responses to market-based programs, a topic that has received little attention to date.

2.1 Review of U.S. Applications of Market-Based Instruments

There have been primarily six applications of market-based instruments in the United States above the local level: the U.S. Environmental Protection Agency's (EPA) Emissions

Trading Program, the leaded gasoline phasedown, water quality permit trading, CFC trading, the SO_2 allowance system for acid rain control, and the RECLAIM program in the Los Angeles metropolitan region.

2.1.1 EPA's Emissions Trading Program

Beginning in 1974, EPA experimented with "emissions trading" as part of the Clean Air Act's program for improving local air quality. Firms that reduced emissions below the level required by law received "credits" usable against higher emissions elsewhere. Companies could employ the concepts of "netting" or "bubbles" to trade emissions reductions among sources within the firm, so long as total, combined emissions did not exceed an aggregate limit.[14]

The "offset" program, which began in 1976, goes further in allowing firms to trade emission credits. Firms wishing to establish new sources in areas that are not in compliance with ambient standards must offset their new emissions by reducing existing emissions. This can be accomplished through internal sources or through agreements with other firms. Finally, under the "banking" program, firms may store earned emission credits for future use. Banking allows for either future internal expansion or the sale of credits to other firms.

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[14] The "netting" and "bubbles" concept aggregates emissions from all the components of an industrial plant and considers them a single source for purposes of regulation. An evaluation of the EPA's Emissions Trading Program can be found in Tom Tietenberg, *Emission Trading: An Exercise in Reforming Pollution Policy.* Washington, D.C.: Resources for the Future, 1985. For a broader assessment of the EPA's experience with tradable permit policies, see Robert W. Hahn. "Economic Prescriptions for Environmental Problems: How the Patient Followed the Doctor's Orders." *Journal of Economic Perspectives* 3 (1989): 95-114.

EPA codified these programs in its Emissions Trading Program in 1986,[15] but the programs have not been widely used. States are not required to use the Program, and uncertainties about its future course seem to have made firms reluctant to participate.[16] Nevertheless, companies such as Armco, DuPont, USX, and 3M have traded emissions credits, and a market for transfers has long since developed.[17] Even this limited degree of participation in EPA's trading programs may have saved between $5 billion and $12 billion over the life of the program.[18]

2.1.2 Lead Trading

The purpose of the lead trading program, developed in the 1980s, was to allow gasoline refiners greater flexibility in meeting emission standards at a time when the lead-content of gasoline was reduced to 10 percent of its previous level. In 1982, the EPA authorized inter-refinery trading of lead credits.[19] If refiners produced gasoline with a lower lead content than was required, they earned lead credits. In 1985, EPA initiated a program allowing refineries to

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[15] U.S. Environmental Protection Agency, *Emissions Trading Policy Statement,* 51 Fed. Reg. 43,814 (1986) (final policy statement).

[16] See Liroff, Richard A. *Reforming Air Pollution Regulations: The Toil and Trouble of EPA's Bubble*. Washington, D.C.: Conservation Foundation, 1986.

[17] See Main, Jeremy. "Here Comes the Big New Cleanup." *Fortune* (November 1988): p. 102-118.

[18] See Hahn, Robert W. and Gordon L. Hester. "Where Did All the Markets Go? An Analysis of EPA's Emissions Trading Program." *Yale Journal of Regulation* 6 (1989): 109-153.

[19] U.S. Environmental Protection Agency. *Regulation of Fuel and Fuel Additives.* 38,078-90 (proposed rule). 49,322-24 (final rule).

"bank" lead credits, and subsequently firms made extensive use of this program.[20] EPA terminated the program it at the end of 1987, when the lead phasedown was complete.

The lead program was clearly successful in meeting its environmental targets. And, although the benefits of the trading scheme are more difficult to assess, trading activity suggests that the program was relatively cost-effective. The high level of trading between firms far surpassed levels observed in earlier environmental markets.[21] And, in 1985, over half of all refineries participated in trading with other firms.[22] EPA estimated savings from the lead trading program of approximately twenty percent over alternative programs that did not provide for lead banking,[23] a cost savings of about $250 million per year.

2.1.3 Water Quality Permit Trading

The United States has had very limited experience with tradable permit programs for controlling water pollution, though nonpoint sources, particularly agricultural and urban runoff, may constitute the major, remaining American water pollution problem.[24] An

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[20] In each year of the program, more than 60 percent of the lead added to gasoline was associated with traded lead credits. See Robert W. Hahn and Gordon L. Hester, "Marketable Permits: Lessons for Theory and Practice," *Ecology Law Quarterly* 16 (1989): 361-406.

[21] The program did experience some relatively minor implementation difficulties related to the importation of leaded fuel. It is not clear that a comparable command-and-control approach would have done better in terms of environmental quality. See U.S. General Accounting Office, *Vehicle Emissions: EPA Program to Assist Leaded-Gasoline producers Needs prompt Improvement,* GAO/RCED-86-182 (Washington, DC: U.S. GAO, August 1986)

[22] See Hahn, Robert and Hester, Gordon. "Marketable Permits: Lessons for Theory and Practice." *Ecology Law Quarterly* 16 (1989): 361-406.

[23] See U.S. Environmental protection Agency, Office of policy analysis, *Costs and Benefits of Reducing Lead in Gasoline, Final Regulatory Impact Analysis.* Washington, DC: February 1985.

[24] See Peskin. "Nonpoint Pollution and National Responsibility." *Resources* (Spring 1986): p. 10-11.

"experimental program" to protect the Dillon Reservoir in Colorado demonstrates how tradable permits could be used, in theory, to reduce nonpoint-source water pollution.

Dillon Reservoir is the major source of water for the city of Denver. Nitrogen and phosphorus loading threatened to turn the reservoir eutrophic, despite the fact that point sources from surrounding communities were controlled to best-available technology standards.[25] Rapid population growth in Denver, and the resulting increase in urban surface water runoff, further aggravated the problem.

In response, state policy makers developed a point-nonpoint-source control program to reduce phosphorus flows, mainly from nonpoint urban and agricultural sources.[26] The program was implemented in 1984.[27] It allowed publicly owned sewage treatment works to finance the control of nonpoint sources in lieu of upgrading their own treated effluents to drinking water standards.[28] EPA estimated that the plan could save over $1 million per year,[29] due to large differences in the marginal costs of control between nonpoint sources and

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[25] See Office of Policy Analysis, Environmental Protection Agency. "Case Studies on the Trading of Effluent Loads, Dillon Reservoir." Final Report, 1984.

[26] See Hahn, Robert. "Economic Prescriptions for Environmental Problems: How the Patient Followed the Doctor's Orders." *Journal of Economic Perspectives* 3 (1989): p. 103.

[27] See Kashmanian, R. "Beyond Categorical Limits: The Case for Pollution Reduction Through Trading." Unpublished paper presented at the 59th Annual Conference of the Water Pollution Control Federation, 1986.

[28] See Hahn, Robert. "Economic Prescriptions for Environmental Problems: How the Patient Followed the Doctor's Orders." *Journal of Economic Perspectives* 3 (1989): p. 103.

[29] See Hahn, Robert and Hester, Gordon. "Marketable Permits: Lessons for Theory and Practice." *Ecology Law Quarterly* 16 (1989): 395.

the sewage treatment facilities. However, no trading ever occurred under the program,[30] apparently because high regional precipitation essentially eliminated its need.

2.1.4 CFC Trading

A market in tradable permits was used in the United States to help comply with the Montreal Protocol, an international agreement aimed at slowing the rate of stratospheric ozone depletion.[31] The Montreal Protocol called for reductions in the use of CFCs and halons, the primary chemical groups thought to lead to ozone depletion. The market places limitations on both the production and consumption of CFCs by issuing allowances that limit these activities. The Montreal Protocol recognizes the fact that different types of CFCs are likely to have different effects on ozone depletion. Therefore, each CFC is assigned a different weight on the basis of its depletion potential. If a firm wishes to produce a given amount of CFC, it must have an allowance to do so,[32] calculated on this basis.

Through mid-1991 there were 34 participants in the market and 80 trades.[33] However, the overall efficiency of the market is difficult to determine, because no studies were conducted to estimate cost savings. The timetable for the phaseout of CFCs was subsequently

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[30] See Hahn, Robert and Hester, Gordon. "Marketable Permits: Lessons for Theory and Practice." *Ecology Law Quarterly* 16 (1989): 395.

[31] The Montreal Protocol called for a 50-percent reduction in the production of CFCs from 1986 levels by 1998. In addition, the Protocol froze halon production and consumption at 1986 levels beginning in 1992.

[32] The system was designed with allowances to limit both domestic production and consumption. See Hahn, Robert W and McGartland, Albert M. "Political Economy of Instrumental Choice: An Examination of the U.S. Role in Implementing the Montreal Protocol." *Northwestern University Law Review* 83 (1989): p. 592-611.

[33] Letter from Richard D. Feldman, U.S. Environmental Protection Agency, 7 January 1991. In addition, there have been a very small number of international trades. Such trading is limited by the Montreal Protocol.

accelerated, and a tax on CFCs was introduced. Indeed, the tax may have become the binding (effective) instrument.[34] Nevertheless, relatively low transaction costs associated with trading in the CFC market suggest that the system was relatively cost-effective.

2.1.5 SO_2 Allowance System

A centerpiece of the Clean Air Act Amendments of 1990 is a tradable permit system that regulates sulfur dioxide (SO_2) emissions, the primary precursor of acid rain.[35] Title IV of the Act reduces sulfur dioxide and nitrous oxide emissions by 10 million tons and 2 million tons, respectively, from 1980 levels.[36] The first phase of sulfur dioxide emissions reductions was achieved by 1995, with a second phase of reduction to be accomplished by the year 2000.

In Phase I, individual emissions limits were assigned to 111 electrical utilities. After January 1, 1995, these utilities could emit sulfur dioxide in excess of limitations only if they qualified for extensions or substitutions, or if they obtained allowances for their total emissions.[37] During Phase I, the EPA allocated each affected utility, on an annual basis, a specified number of allowances related to its capacity, plus bonus allowances available under a

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[34] As of 1992, no firms were producing CFCs up to their maximum allowable level and permits could not be banked (carried forward). As a result, there was an excess supply of permits. It is possible, however, that there would be an excess supply even if there were no tax and with an effective price of zero for permits, because firms reacted to changes in regulations and new policy initiatives that called for a more rapid phaseout of CFCs and halons.

[35] See Clean Air Act Amendments of 1990, Public Law No. 101-549, 104 Statute 2399, 1990.

[36] For a description of the legislation, see Ferrall, Brian L. "The Clean Air Act Amendments of 1990 and the use of Market Forces to Control Sulfur Dioxide Emissions." *Harvard Journal on Legislation* 28 (1991): 235-252.

[37] Under specified conditions, utilities that had installed coal scrubbers to reduce emissions could receive two-year extensions of the Phase I deadline plus additional allowances.

variety of special provisions.[38] Cost-effectiveness was promoted by permitting allowance holders to transfer their permits among one another.

Under Phase II of the program, beginning January 1, 2000, almost all electric power generating units will be brought within the system.[39] Certain units are excepted to compensate for potential restrictions on growth and to reward units that are already unusually clean. If trading permits represent the carrot of the system, its stick is a penalty of $2,999 per ton of emissions that exceed any year's allowances (and a requirement that such excesses be offset the following year).[40]

A robust market of bilateral SO_2 permit trading has emerged, resulting in cost savings in the order of $1 billion annually, compared with the cost savings under command-and-control regulatory alternatives. Nevertheless, the program has fallen short of predictions in terms of the number of permits traded and the price of permits.[41] But this may have more to do with faulty predictions than problematic performance. Despite earlier concerns that state regulatory

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[38] Utilities that install scrubbers receive bonus allowances if they clean up early. In addition, specified utilities in Ohio, Indiana, and Illinois receive extra allowances during both phases of the program. All of these extra allowances are essentially tradable (and bankable) compensation intended to benefit midwestern plants, which presently rely on high-sulfur coal. On the political origins of this aspect of the program, see: Joskow, Paul L. and Richard Schmalensee. *The Political Economy of Market-based Environmental Policy: The 1990 U.S. Acid Rain Program.* Draft manuscript, MIT, 1995.

[39] In general, units with a capacity of 75 MW or more that emit sulfur dioxide at a rate of 1.2 pounds per million Btu face limitations on total emissions related to their actual energy generation during the period 1985-1987.

[40] Clean Air Act Amendments of 1990.

[41] While the EPA predicted in 1990 that the marginal abatement cost (and therefore the price at which permits would trade) was $750 per ton, allowances were trading privately at the end of 1995 at about $170 per ton, and in the EPA auction administered by the Chicago Board of Trade, from $122 to $140. For a detailed analysis of the experience with the program to date, and in particular the reasons for the reduction in abatement costs, see Burtraw, Dallas. "Cost Savings Sans Allowance Trades? Evaluating the SO_2 Emission Trading Program To Date." Discussion Paper 95-30. Resources for the Future. September 1995.

authorities would hamper trading in order to protect their domestic coal industries, preliminary evidence suggests that this has not been a major problem.[42] Similarly, in contrast to early assertions that the structure of EPA's small permit auction market would cause problems,[43] the evidence now indicates that this has had little or no effect on the vastly more important bilateral trading market.[44]

Later in this chapter, we consider some of the reasons the SO_2 program has not met all expectations; in summary, changes in the coal market and the costs of appropriate technologies have resulted in lower marginal abatement costs than predicted, and, in addition, some "market failures" may have caused permit prices to be lower than marginal abatement costs.

2.1.6 The RECLAIM Program

The South Coast Air Quality Management District (SCAQMD), which is responsible for controlling emissions in a four-county area of Southern California, launched a tradable permit program in January 1994 to reduce nitrogen dioxide and sulfur oxide emissions in the Los Angeles area.[45] As of June 1996, 353 participants in this Regional Clean Air Incentives

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[42] Bailey, Elizabeth M. "Allowance Trading Activity and State Regulatory Rulings: Evidence from the U.S. Acid Rain Program." MIT-CEEPR 96-002 WP, Center for Energy and Environmental Policy Research, Massachusetts Institute of Technology, 1996.

[43] Cason, Timothy N. "An Experimental Investigation of the Seller Incentives in EPA's Emission Trading Auction," *American Economic Review* 85(1995):905-922.

[44] Joskow, Paul L., Richard Schmalensee, and Elizabeth M. Bailey. "Auction Design and the Market for Sulfur Dioxide Emissions." Paper presented at the National Bureau of Economic Research Workshop on Public Policy and the Environment, Cambridge, Massachusetts, 1996.

[45] For a detailed case study of the evolution of the use of economic incentives in the SCAQMD, see chapter 2 in *The Environment Goes to Market: The Implementation of Economic Incentives for Pollution Control*. National Academy of Public Administration, July 1994.

Market (RECLAIM) Program, have traded more than 100,000 tons of nitrogen oxide (NO_x) and SO_2 emissions, at a value of over $10 million.[46]

The RECLAIM program, which operates through the issuance of permits that authorize specified decreasing levels of pollution over time, presently governs stationary sources that have emitted more than four tons of NO_x and SO_2 since 1990.[47] The SCAQMD is now considering expanding the program to allow trading between stationary and mobile sources.[48]

2.2 Assessing the U.S. Experience: Limited Use of Instruments

Notwithstanding the varying levels of success in the implementation of specific programs, market-based instruments have yet to fundamentally transform the landscape of U.S. environmental policy. Indeed, market-based instruments still exist only at the fringes of regulation, and have not become a central component of private firms' environmental decision making.

2.2.1 A Stock-Flow Problem

Market-based instruments represent only a small share of new regulation and a trivial portion of existing regulation. The reasons for this are many. Perhaps the most obvious is that there has not been a great deal of new environmental regulation. Since 1990, the Clean Air Act and Safe Drinking Water Act are the only major environmental regulations to be reauthorized. And

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46 See Brotzman, Thomas. "Opening the Floor to Emissions Trading." *Chemical Marketing Reporter* (May 27, 1996): p. SR8.

47 Some sources, such as equipment rental facilities and essential public services (including landfills and wastewater treatment facilities), are excluded. For a description of the program rules see pages 55-59 in *The Environment Goes to Market: The Implementation of Economic Incentives for Pollution Control*. National Academy of Public Administration, July 1994.

48 See Fulton, William. "The Big Green Bazaar." *Governing Magazine* (June 1996): page 38.

even when Congress has been willing to consider market-based instruments for creating new regulation, the political will has not existed to proactively reopen existing legislation. Given that Title 40 of the Code of Federal Regulations, titled "Protection of the Environment," contains over 14,310 pages of environmental regulations, it could take a very long time indeed for market instruments to become the core of environmental policy, unless Congress is willing to use them for "old" problems as well as new ones. For example, while the Clean Air Act (CAA) Amendments of 1990 established the SO_2 tradable permits program, the remainder of the Act that dealt with mobile sources, hazardous air pollutants, and local air pollution relied on conventional controls. Therefore, the next clear opportunity to apply market incentives to other areas of the Act may not arise for many years to come.

2.2.2 The Role of Interest Groups

Within the government environmental bureaucracy there clearly exists a desire to see effective environmental regulation adopted. However, most of the EPA employees were originally hired to oversee traditional command-and-control programs and are at least implicitly concerned with ensuring that the skills they possess will be needed to ensure the success of any new regulation. Consequently, they may not focus their skills on furthering the use of market-based instruments to achieve environmental goals. Furthermore, traditional regulatory programs require regulators with a technical or legal-based skill-set, but market-based instruments require market-trained thinkers, including

MBAs, economists, and others. Members of the government bureaucracy are rationally resisting the dissipation of their human capital.[49]

Within environmental organizations as well, efforts to increase the use of market-based instruments are sometimes hampered. Although some environmental groups have increasingly welcomed the selective use of market-based instruments,[50] others are concerned that increased flexibility in environmental regulation will result in the reduction of the overall level of environmental protection. Furthermore, in parts of the environmental community, the sentiment still remains that environmental quality is an inalienable right and that market-programs, such as permit programs, condone the "right to pollute" and thereby curtail this right. Lastly, some environmental professionals, like their government counterparts, may be resisting the dissipation of *their* human capital.

2.2.3 Ambivalence Towards Better Regulation

The ambivalence of the regulated community itself has also undermined the use and effectiveness of market-based instruments. Many industries and companies have applauded market-based instruments in an abstract sense because of their promise of flexibility and cost effectiveness. For instance, in its landmark work, *Changing Course,* the Business Council for Sustainable Development described how economic instruments could be used to meet

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[49] Hahn, Robert W. And Robert N. Stavins. "Incentive-based Environmental Regulation: a New Era from an Old Idea?" *Ecology Law Quarterly* 18(1991): 1-42.

[50] During the mid to late 1980's, the Environmental Defense Fund (EDF) was the first environmental advocacy organization to aggressively welcome the use of market-based instruments. See: Krupp, Frederic. "New Environmentalism Factors in Economic Needs." *Wall Street Journal*, November 20, 1986: p. 34.

environmental objectives at reduced costs. As a practical matter, however, the vast majority of businesses have not enthusiastically applied or implemented these instruments.

Much of the hesitation stems from a reluctance to promote any regulation, no matter how flexible or cost effective. Businesses are cautious or even fearful of the regulatory process. They often perceive – perhaps seasoned by experience – that political forces beyond their control might unfavorably distort the design and implementation of these instruments. First is a fear that any cost savings will be taken away from them and be used exclusively to increase the overall level of environmental clean up. As one business representative noted, "these instruments are often seen as a way to up the ante."[51] Second, the actual design of the instrument may be developed in a way that distorts their flexibility and penalizes companies. For instance, in connection with the implementation of the SO_2 regulations, several states in high-sulfur coal states attempted to skew the regulations by forcing companies to install high-cost scrubbers, instead of shifting to more economical low-sulfur, western coal.

A third concern dampening businesses' enthusiasm is the fear that the rules will change over time. Environmental investments can often be very large (e.g., tens of millions of dollars). For businesses to optimize these investments, regulations not only have to be flexible, but predictable over time. Many business leaders are skeptical that any administration can "deliver the government" in the necessary way. Using acid rain again as an example, changes have been proposed by the EPA to the permit bidding process. And, the American Lung

[51] Alter, Harvey, Manager, Resources Policy, U.S. Chamber of Commerce, personal communication, July 19, 1996.

Association has sued EPA in an attempt to force them to tighten SO_2 standards.[52] Whether or not this would be desirable for environmental reasons, it represents a potential significant changing of the rules of the game for companies who invested under different scenarios.

Given the anti-regulation climate pervading Washington, firms have been able to argue *against* any regulation rather than *for* better regulation. To the extent that environmentally sensitive industries have felt compelled to act, they have pursued voluntary rather than compulsory regulatory approaches. The chemical industry, for example, has developed its Responsible Care codes and argued that this can obviate the need for intensive regulation. The petroleum and paper industries have similar initiatives. The success of these programs – or at least the energy being directed towards them – may have diverted attention away from market incentive approaches.[53]

Finally, firms are concerned that “buying the right to pollute” under emission trading programs could lead to negative publicity. Even though the purchases and trading of permits are completely legal, and they help improve the environment at a lower overall cost to society, an uninformed citizen may perceive such behavior to be unethical.[54]

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[52] See Lobsenz, George. “Lung Association Sues EPA Over SO2 Standard.” *The Energy Daily*. July 22, 1996, page 3.

[53] In 1990, the industry took on the goal of recovering 40% of all paper used in the U.S. by 1995. They achieved this goal one year early, and are now working toward reaching 50% recovery by 2000. Dick Storat, Vice-President, Policy Research, American Forest and Paper Association, personal communication, July 26, 1996.

[54] It should also be pointed out that another reason private industry personnel may be resistant to policy reforms is to protect their own importance within their firms, i.e. they may be resisting the dissipation of *their* human capital.

2.2.4 Consumer Experience

The slow penetration of market-based instruments into environmental policies is also a function of these instruments not being widely understood by the public. Unfortunately, the benefits are typically not visible while the perceived negatives are quite transparent. Under traditional command-and-control policies, the costs of compliance are most often buried within a firm's capital and cost structure. While a consumer may see prices go up, they typically have difficulty associating this with the environmental regulations. By extension, they have very limited ability to experience firsthand the cost effectiveness of MBI – it simply is *not* readily apparent to consumers that both gasoline and electricity prices are lower than they otherwise would have been because of the use of market-based programs to phase out, lead, or reduce SO_2 emissions.

Moreover, market-based instruments – especially charges – may suffer from making environmental costs *more* transparent. While encouraging individuals to consciously link environmental costs and benefits may be a good thing, it can undermine the enthusiasm with which market-based instruments are embraced. Finally, these instruments have been an easy target for opponents who paint a picture for consumers that companies are simply paying to pollute. While the fallacy of this view is unquestionable, especially compared to command-and-control instruments which even *give away* the right to pollute, the public relations imagery has been compelling.

2.3 Assessing the U.S. Experience: A Mixed Record on Performance

In Section 2.2 we examined some of the reasons why market-based instruments have not become widely used in the environmental policy arena. We now turn our attention to the reasons why, when they have been used, market-based instruments have not always performed as well as predicted.

2.3.1 Inaccurate Predictions

One of the reasons market-based instruments have fallen short in delivering the cost savings predicted is that the predictions themselves have often been unrealistic – they were premised on perfect performance under *ideal* conditions. That is, these predictions have implicitly assumed that the cost-minimizing allocation of the pollution-control burden among sources would be achieved, and that marginal abatement costs would be perfectly equated across all sources.[55]

Also contributing to the inaccuracy of the predictions is the fact that they were based on comparisons of actual command-and-control results with theoretical least-cost benchmarks. In a frequently cited table, Tietenberg calculated the ratio of the cost of an actual command-and-control program to a least-cost benchmark.[56] Others have mistakenly used this ratio as an indicator of the potential gains of adopting specific market-based instruments. The more appropriate comparison would be between actual command-and-control programs and either actual or reasonably constrained theoretical market-based programs.

In addition, predictions made during policy debates have typically ignored a number of factors that can adversely affect performance: transaction costs involved in implementing

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[55] See: Hahn, Robert and Robert Stavins. “Economic Incentives for Environmental Protection: Integrating Theory and Practice.” *American Economic Review* 82 (May 1992): 464-468

[56] See: Tietenberg, Tom. *Emissions Trading: An Exercise in Reforming Pollution Policy*. Washington, D.C.: Resources for the Future, 1985.

market-based programs;[57] uncertainty as to the property rights bestowed under programs; competitive market conditions;[58] a pre-existing regulatory environment that does not give firms appropriate incentives to participate; and the inability of firms' internal decision-making capabilities to fully utilize program opportunities.

The SO_2 allowance trading program is a high-profile example where overly optimistic predictions were made. The program was originally predicted to cut the cost of achieving SO_2 reductions by up to $3 billion annually.[59] It is now predicted to result in savings of only about $1 billion annually.[60] Further, the price and quantity of permit trading has been lower than originally predicted. This is partly due to the fact that the marginal cost of abatement has been lower than expected for reasons related to changes in input markets, primarily the fall in the price of low-sulfur coal due to railroad deregulation[61] and innovations in fuel blending that have enabled more fuel switching.[62] Permit prices may be lower than marginal abatement

[57] See: Stavins, Robert. "Transaction Costs and Tradable Permits." *Journal of Environmental Economics and Management* 29 (Sept. 1995): 133-147.

[58] For a discussion of how concentration in the permit market would be possible if a 20% recycled-content standard was applied to newsprint production, see: Dinan, Terry M. "Increasing the Demand for Old Newspapers Through Marketeable Permits: Will It Work?" Paper presented at the Association of Environmental and Resource Economists Workshop on Market Mechanisms and the Environment, Madison, Wisconsin, June 7-8, 1990.

[59] See ICF, Inc. *Analysis of Six and Eight Million Ton 30-Year/NSPS and 30-Year/1.2 Pound Sulfur Dioxide Emission Reduction Cases.* Washington, D.C., February 1986.

[60] Hahn, Robert and Carol May. "The Behavior of the Allowance Market: Theory and Evidence." *Electricity Journal*, Vol. 8 (March 1994): p. 28-37.

[61] See Ellerman, A. Denny and Juan Pablo Montero. "Why Are Allowance Prices So Low? An Analysis of the SO_2 Emissions Trading Program." Center for Energy and Environmental Policy Research, Massachusetts Institute of Technology, February 1996.

[62] See Burtraw, Dallas. "Cost Savings Sans Allowance Trades? Evaluating the SO_2 Emission Trading Program to Date." Discussion Paper 95-30. Resources for the Future, Sept. 1995.

costs also for the following reasons: utilities' reluctance to consider new options; constraints imposed on utilities by contractual precommitments;[63] the preexisting regulatory environment, including locally binding regulations and rate-of-return regulations; regulatory uncertainty; permit property rights questions;[64] and transaction costs.

2.3.2 Design Problems

Many of the factors cited suggest the need for changes in the design of future market-based instruments. While some program design elements reflect miscalculations of market reactions, others were known to be problematic at the time the programs were enacted, but nevertheless were incorporated into programs to ensure adoption by the political process. One striking example is the adoption of a "20% rule" under the EPA's Emission Trading Program. This rule, adopted at the insistence of the environmental community, stipulated that each time a permit was traded, the amount of pollution authorized thereunder would be reduced by 20%. Since those permits that were not traded retained their full value, this regulation discouraged permit trading and thereby increased regulatory costs.

2.3.3 Limitations in Firms' Structure

A third set of explanations for the mixed performance of implemented market-based instruments reflects limitations in private firms' internal structures and skill sets. Market-based instruments require a very different set of decisions than do traditional command-and-control

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[63] Coggins, J. S. and V. H. Smith. "Some Welfare Effects of Emission Allowance Trading in a Twice-Regulated Industry." *Journal of Environmental Economics and Management* 25(1993):275-297.

[64] Bohi, Douglas R. and Dallas Burtraw. "Utility Investment Behavior and the Emission Trading Market." *Resources and Energy* 14(1992):129-153.

approaches. Most firms are simply not equipped internally to make the decisions necessary to fully utilize these instruments.

Since market-based instruments have been used on a limited basis only, and firms are not certain that these instruments will be a lasting component on the regulatory landscape, most companies have chosen not to reorganize their environmental, health and safety (EH&S) departments in the manner necessary to fully exploit the cost savings these instruments offer. Rather, most firms continue to have organizations that are experienced in minimizing the costs of complying with command-and-control regulations, not in making the *strategic* decisions required by market-based instruments.

There are some exceptions. Enron, for example, has attempted to use market-based instruments for its strategic benefit by becoming a leader in creating new markets for trading acid rain permits. Other firms have appointed EH&S leaders who are familiar with a wide range of policy instruments, not solely command-and-control approaches, and who bring a strategic focus to their company's pollution-control efforts.

Although changes in leadership in some EH&S departments may reflect a perceived need for a changed skill set, EH&S staff members are still generally unequipped to handle emerging environmental issues in a business context. As lawyers and engineers, *not* MBAs, they are experienced in interpreting detailed regulatory rules and in designing technological solutions to comply with them; they are unprepared to implement the cost-saving decisions that market-based regulations allow. EH&S departments need to be staffed with market-trained thinkers who can analyze the strategic implications of the new options firms face.

EH&S departments are further impaired by the fact that their functions are not sufficiently integrated with those of the business units. Links have rarely developed between environmental decision-makers and business unit decision-makers. In many cases, environmental costs are not fully measured and are not driven back to the business units from which they derive. This faulty perception has limited companies' ability to make the few strategic decisions required under traditional command-and-control approaches (such as including information about the cost to alternative plants of meeting environmental regulations when making production decisions). When companies face the much broader set of strategic issues raised by market-instruments, the lack of integration of EH&S with business units becomes a more pressing problem.

The focus of EH&S departments has been primarily on problem avoidance and risk management, rather than on the creation of opportunities made possible by market-based instruments. This focus has developed because of the strict rules companies face under command-and-control regulation, in response to which companies have built skills and developed processes that comply with regulations but do not help them to benefit competitively from their environmental decisions. While business managers may try to push for more cost-effective solutions, they often lack the knowledge (and environmental confidence) to take on the technical experts and push for the best solutions. Those firms that have been most effective in addressing these issues have moved general managers through their EH&S departments as part of their development and more closely integrated environmental issues into their capital and business planning processes. Absent this shift in mindset, the full potential of market-based instruments – cost-effectiveness and improved incentives for technological change – will *not* be realized.

3. HOW CAN WE ADVANCE THE "NEXT GENERATION" OF MARKET-BASED INSTRUMENTS?

We have now examined the reasons why market-based instruments have not gained as much importance as predicted, both in terms of scope of their use and performance delivered when they have been implemented. It might be argued that the factors that have prevented market-based instruments from functioning as well as policymakers predicted may constitute an insurmountable obstacle to their playing a fundamental role in future environmental policy. We believe, however, that the successes of the past, and the lessons learned from the failures, demand that we not abandon market-based instruments as a policy option, but rather that we make these instruments a vastly more important part of the future environmental policy toolkit.

At the beginning of the decade, EPA estimated that the nation was spending more than $100 billion annually to comply with some Federal environmental laws and regulations,[65] and this amount is likely to rise in the future.[66] As these expenditures rise, environmental policymakers need to seek more effective tools to maintain and improve environmental quality

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[65] See U.S. Environmental Protection Agency, *Environmental Investments: The Cost of a Clean Environment,* report of the administrator to Congress. Washington, D.C.: U.S. EPA, December 1990. This estimate excludes environmental activities not directly associated with pollution control or cleanup, such as wildlife conservation and land management. The $100 billion estimate covers spending by private businesses, local governments, the Federal government, and state governments.

[66] See: Jaffe, Adam B., Steven R. Peterson, Paul R. Portney, and Robert N. Stavins. "Environmental Regulation and the Competitiveness of U.S. Manufacturing: What Does the Evidence Tells Us?" *Journal of Economic Literature* 33(1995):132-163.

in a cost-effective manner. This need dictates that the potential of market-based for reduced costs and incentives for new technology is more important than ever and must to be pursued.

Market-based instruments have an important role to play in the overall portfolio of approaches to environmental issues. When used properly together with other policy options these instruments can play an exceptionally valuable role in helping society meet its overall environmental goals with minimum economic sacrifice.

From a broader policy perspective, more cost-effective environmental policy could make available public and private resources to address other pressing societal goals, such as reducing poverty, improving education, and reducing violent crime. While the public maintains a high level of concern for environmental issues, it is difficult to argue that exclusive attention should be given to these issues, in the face of so many other pressing social problems, including the decay of inner cities, class and racial divisions, and poverty. Because these other challenges can better be addressed if resources are saved through more cost-effective environmental policies, they underscore the importance of the "next generation" of market-based environmental solutions.

Having assessed the problems associated with the current generation of market-based instruments, and argued that we must increase our efforts to design a more effective new generation of programs, we propose some actions to accomplish that. These suggestions are intended to ensure that more market-based instruments are enacted, and that they realize greater benefits when they are adopted.

(1) *Improve Program Design.* Better design can help overcome concerns of firms and environmental groups, the major constituencies that have not

embraced market-based instruments enthusiastically due to related concerns over long-term importance and predictability. And, better design will mean greater environmental improvements at lower costs.

(2) *Apply Market-Based Instruments on the State Level*. As increased attention and responsibility for environmental policy shift to the states, a significant opportunity exists to ensure that effective market-based approaches are enacted for issuance of permits, waste management, land protection, and water quality improvement.

(3) *Implement Federal Programs.* Several short-term opportunities exist for targeted applications of market-based instruments to important contemporary issues. Two examples are a deposit refund system for hazardous waste, and the use of a revenue-neutral carbon tax (when and if the United States participates in a binding world agreement on net carbon emissions).

(4) *Address Long-Terms Issues.* The stock of existing regulation (rather than simply the flow of new regulation) must be targeted for market-based approaches, and the political opposition to tax charges must be addressed.

3.1 Design Improvements

Improving the design of market-based instruments has the potential to counter the resistance of certain constituencies -- such as private firms and environmental groups -- to implementation of these instruments, as well as to ensure that more of their predicted benefits are realized when used.

While firms and environmental groups approach environmental issues from very different perspectives, they have very similar concerns regarding market-based instruments. Firms have been reluctant to devote excessive resources to lobby for and use these instruments due to concerns over the programs' predictability – whether the rules of the game will be changed on them mid-stream – and uncertainty as to how important they will become compared with command-and-control approaches. Similarly, environmental groups are concerned that market-based instruments – that are unpredictable and too flexible – will lead to less pollution control.

An important first step is to place market-based instruments in their proper context and applying them in appropriate situations. Market-based instruments are not a panacea for all environmental problems. Rather, they are a useful and underutilized element in what should be a portfolio of policy instruments. The first task ahead for policymakers is to formulate decision making hierarchies for developing cost-effective policies. For instance, market forces alone may be sufficient to address some problems (i.e., consumers will change their purchasing behavior when aware of environmental impacts). This is attractive in that it avoids cumbersome rulemaking and monitoring. Second, the government may need to assure that information is made available to communities and consumers. Certainly, the importance of this has been demonstrated by the Toxic Release Inventory and various labeling laws. Third, the government may be able to negotiate agreements with companies or industry groups that also avoid regulation and all that goes along with it. Fourth, when regulation is called for, market-based instruments should be the first option considered. But, many environmental problems will continue to require command-and-control solutions.

When implementing market-based instruments, an overreaching design goal should be to make programs more predictable; in terms of maintaining the rules of the program, ensuring that pollution control targets are met, and creating a program that will remain in place for the long-term. By making programs predictable, policymakers can begin to build support for their adoption.

In addition, market-based instruments should be designed to deliver optimum benefits: reduce transaction costs; increase certainty as to the rights bestowed under the program; ensure competitive market conditions; offer incentives to participate; and provide sufficient information to program participants.

When political pressures necessitate changes in a proposed market-based program, the changes should be made in a manner that does not detract from the programs efficiency. For example, the environmental community's goal of increasing the amount of pollution control through the Emissions Trading Program could have been met more effectively if the 20% rule had been modified. Rather than reducing the quantity-value of traded permits only, the program might have been designed to reduce the quantity-value of all permits (by some amount less than 20%) over a designated period of time. This would not have diminished the pollution-control effect of the program, and would not have created a disincentive to trading. However, lower overall compliance costs would have been the end-result.

3.2 An Elevated State Focus

As the current political climate continues to transfer power from the federal to the state level, it is essential that market-based instruments be included in the state and local environmental regulatory toolkit. While federal spending for environmental control continues to outpace state spending (in 1991, federal spending was about $18.2 billion for environmental and natural resource programs, compared to state spending of $9.6 billion), state spending has been increasing as federal spending decreases.[67] Although most of the current discussion regarding market-based instruments has focused around federal-level initiatives, the application of these instruments on the state level has begun to receive more attention and should become a greater policy focus.

One of the most exciting uses of market-based incentives on the state and local level has been in an area not generally regarded as environmental: the permitting process. A great challenge for state and local governments – and a source of frustration for new and growing companies – is the time required to issue permits for activities such as zoning, construction, and pollution discharge. Some states have developed programs which incorporate incentives – usually in the form of avoiding costs associated with delays – into the existing framework for permits, inspections, and enforcement. For example, expedited evaluations of permit applications are often completed for firms that choose to participate in new pollution prevention programs.[68] While not a market-based instrument in the strict sense, these types of initiatives do embody the spirit of what is called for in the next generation of environmental policy. This approach offers a relatively simple way to give firms incentives to meet environmental goals without intricate legislation.

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[67] For a detailed look at state environmental budgets and policy see chapter 4, "An Overview of State Environmental Policy" in John, DeWitt. *Civic Environmentalism: Alternatives to Regulation in States and Communities.* Congressional Quarterly: Washington, D.C., 1994.

[68] For a detailed indexing of state command-and-control and market-based instruments, see "Incentive-based vs. command-and-control approaches to improving environmental quality," *Spectrum: The Journal of State Government.* Vol. 68, No. 4 (Sept. 22, 1995): page 6.

The opportunity also exists to use market-based instruments to directly address the environmental issues at which most state-launched independent initiatives are directed:[69] waste management; land use; and air quality improvement.

3.2.1 Waste Management

At the core of most municipal solid-waste problems are flawed price signals that fail to convey to consumers and producers the true costs of the wastes they generate. The costs of waste collection and disposal are generally unknown because, in most communities, they are embedded in property or other taxes. Market-based instruments can be used to ensure that solid-waste creation and disposal decisions are more closely linked to their actual costs.

Some municipalities have highlighted the costs of waste disposal by labeling a separate charge for waste collection in their semi-annual property tax assessments. However, because charges usually are levied as flat fees that do not vary with the quantity of waste generated by a particular person, no incentive exists to modify purchasing and disposal decisions.

Fundamental to an effective waste-management strategy is getting the prices right. Unit pricing is an attractive way to correct this situation. By charging households for waste collection services in proportion to the amount of refuse they leave at the curbside, unit pricing can tie household charges to the real costs of collection and disposal. This method creates strong incentives for households to reduce the quantities of waste they generate, whether

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[69] For a discussion of which problems states are addressing, see chapter 4, "An Overview of State Environmental Policy" in John DeWitt. *Civic Environmentalism: Alternatives to Regulation in States and Communities*. Congressional Quarterly: Washington, D.C., 1994.

through changes in their purchasing patterns, reuse of products and containers, or composting of yard wastes.

Furthermore, by placing higher unit charges on unseparated refuse than on specified, separated recyclables, cities can create incentives for households to separate the recyclable components of their trash. While encouraging reductions in the solid-waste flow, unit pricing also provides flexibility to consumers and producers in making their consumption and production decisions.

If municipalities are to rely on unit pricing for collection and disposal services, they need to consider several important design and implementation issues. In some of the initial forays into unit pricing, several communities, including Seattle, billed households for the number and size of trash receptacles they left at the curbside. This billing method resulted in a substantial reduction of the total flow of solid waste into landfills, but it raised fairness concerns because low-income households likely paid a greater percentage of their incomes for garbage pickup than did higher-income households. The Seattle system has addressed this issue much as electric utilities do -- with low “life-line rates” for initial blocks of usage.

Per-can pricing is a step in the right direction, but “bag-and-tag” systems -- where households dispose of unseparated refuse in specially designated trash bags sold by the municipality -- can do an even better job of linking costs to disposal volumes.

A related approach involves the sale of stickers that are placed on cans or bags of specified dimensions. While metering and billing costs for bag-and-tag systems can be kept low, illegal dumping is a concern under this type of system. The experiences of Seattle and other communities suggest, however, that illegal dumping may not be a problem if systems are designed properly. New programs can be introduced incrementally, with charges rising gradually until they equal the true marginal cost of disposal. Also, municipalities can provide free or low-cost disposal at transfer stations, thus removing some of the incentive to dump illegally. Furthermore, stiff penalties for illegal disposal can be an effective deterrent.

Finally, unit pricing has obvious limitations in multi-unit apartments where residents can dispose of their waste anonymously, thus free-riding on the charges paid by others. Clearly, unit charges are not a panacea for solid-waste management problems, but by providing a high degree of choice to consumers and firms, this approach combines cost-effectiveness with minimum inconvenience.

3.2.2 Land Use

With increasing frequency, acrimonious public debates over balancing economic growth with environmental protection are centered around land use decisions. As economic and population growth continues, a larger share of environmental problems will be associated with tensions over land use. Market-based instruments have been used to a limited extent in this area, and the opportunity may exist to widen their application.

Land trading systems – a version of a tradable permit program – have been adopted in several states, including New Jersey, Florida, and California. Florida's wetlands mitigation banking program was established in 1993 and allows the state and five local water management districts to license owners of wetlands property as mitigation bankers.[70] Private developers can purchase a mitigation credit from those bankers who agree to preserve, and often improve, their

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[70] See Fulton, William. "The Big Green Bazaar," *Governing Magazine* (June 1996): page 38.

wetlands; the amount of mitigation credits required to offset a development is based on the type of land which will be developed. Even before the program was formally established, a group of entrepreneurs set up Florida Wetlandsbank, which sells mitigation credits for $45,000 per acre and uses part of the proceeds to improve degraded wetlands.

These programs clearly have complex implementation issues to be resolved; devising methods to compare different types of lands, along such dimensions as biodiversity levels, is a challenge. However, market-based solutions have the potential to help reduce the degree of conflict usually associated with such development decisions.

3.2.3 Air Quality

Building off the much discussed RECLAIM trading program in Los Angeles in 1994, several other states have also launched -- or are in the process of launching -- their own air emissions trading programs.[71] In order to be successful, these programs must incorporate into their design the policy lessons learned to date from experiences with market-based instruments. Several program designers are already in danger of repeating the mistakes of their predecessors.

One program that faced implementation problems is Michigan's emission trading program. The program, which allows companies that exceed current regulatory requirements to sell emission credits to other companies, covers volatile organic compounds (VOCs) and all criteria pollutants (except ozone).[72] Although the program took effect on March 16, 1996, it has yet to

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[71] For a comprehensive list of these programs see the "Emissions Trading Programs" index on page 14 of "Innovative Strategies Guidebook for Criteria Pollutants and Toxics," U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards, Innovative Strategies & Economics Group.

[72] See "AQD (Michigan Department of Environmental Quality) Establishes Emission Trading Program, Issues Final Rules," *Michigan Environmental Compliance Update*, Vol. 7, Issue 2 (May 1996).

be approved by the EPA, due to administrative delays as well as concerns over the program's ability to meet regulatory control standards. The uncertainty as to whether the current rules will be the final ones is likely to limit the enthusiasm of firms to participate in the program.

As other emission trading programs are instituted -- such as New Jersey's proposed program for NO_X and VOCs, and Connecticut's program which authorizes trading of New Jersey emission credits,[73] officials must ensure that they are designed to encourage maximum participation.

3.3 Targeting Federal Efforts

While working to incorporate the use of market-based instruments on the state and local level, policymakers should also work towards adopting new incentive programs on the federal level that address important contemporary issues. We consider two potential applications: a deposit refund system for hazardous waste and the use of a revenue-neutral carbon tax (to reduce carbon emissions when and if the United States decides to participate in a binding world agreement).

3.3.1 Hazardous Waste Deposit Refund Systems

While the unit pricing program for municipal waste is useful in reducing the amount of waste created, it does not provide incentives for changing disposal methods, a challenge that

[73] See "Connecticut Officials: NOx Trading An Early Success, with 10,120 ERCs Approved," *Utility Environment Report*. November 24, 1995; "N.J. Proposes Emission Trading Rules to Establish An Open Market System," *Industrial Energy Bulletin*, May 3, 1996; "Model Emissions-Trading Proposal Drafted for Northeast's NOx Cuts," *Air/Water Pollution Report's Environment Week*. March 1, 1996.

must be faced by any hazardous waste system. Deposit refund systems can create incentives for firms and individuals to dispose of wastes properly and to search for more benign substitutes.

These systems combine a special front-end charge – the deposit – with a refund payable when quantities of the substance in question are turned in for recycling or proper disposal. This is the concept behind the bottle bills many states have adopted. Although deposit refund systems have been applied primarily at the state level, federal intervention is preferable for some substances and problems, such as when firms face national markets with easily transportable products and when the consequences of improper disposal do not vary significantly from one location to another. Geographic homogeneity of charges also reduces the cost and complexity of control, both to firms and to administering agencies.

Deposit refund systems are most relevant for products with high costs of improper disposal; in such cases, the costs of separation and redemption are usually outweighed by the benefits of proper disposal.

One application for which a Federal deposit refund system should be considered is the disposal of lead-acid batteries. The amount of lead that enters landfills and incinerators is a major hazard, particularly in view of the well-documented linkage between lead exposure and childhood learning disabilities.[74] Most of the new lead entering the environment each year is from the improper disposal of storage batteries. Although a substantial amount of lead from motor vehicle batteries is recycled each year, the share of batteries recycled has been decreasing

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[74] See U.S. Environmental Protection Agency Science Advisory Board, *Reducing Risk: The Report of the Human Health Subcommittee, Relative Risk Reduction Project*, Appendix B. EPA SAB-EC-90-021B. Washington, D.C., September 1990.

during the last 30 years. At present, over 20 million unrecycled batteries enter the waste stream annually and this number may increase by more than 30 percent by the year 2000.[75]

Under a deposit refund system, a deposit tax would be collected at the time manufacturers sell batteries to distributors, retailers, or original equipment manufacturers; retailers would then collect their deposits by returning their used batteries to redemption centers; and these redemption centers, in turn, would redeem their deposits from the administering agency. A national program could be designed to accommodate existing deposit systems for batteries, such as those found in Maine and Rhode Island. The deposit would need to be large enough to encourage a substantial level of return but small enough to avoid a significant theft problem.

In addition to a lead-acid battery deposit program, the Federal government should also investigate a deposit refund system for ensuring safe management and disposal of certain "containerizable" hazardous chemicals -- for the most part, liquid chemicals stored in metal drums. About 30 percent of industrial wastes are types which may be generated in small enough quantities per unit to be containerized. One category of such chemicals is chlorinated solvents. While most chlorinated solvents are recycled to some degree by the thousand of firms using them, substantial amounts still reach the environment. Some of the solvents escape in the production process and are released into the atmosphere; more seriously, highly

75 See U.S. Environmental Protection Agency, *Characterization of Products Containing Lead and Cadmium in Municipal Solid Waste in the United States*, 1970-2000. Washington, D.C., January 1989.

contaminated spent solvents are often uneconomical to recycle and may be illegally dumped to avoid disposal costs.[76]

Another potential application of the deposit refund approach is to used lubricating oil. The improper disposal of lubricating oil, currently unaddressed by Federal regulations, is both a health and ecological hazard. When used oil is dumped into storm sewers or placed in unsecured landfills, it can contaminate groundwater and surfacewater supplies; when it is burned as heating fuel, it produces air pollution. Enforcing proper disposal of lubricating oil through conventional regulations would be exceedingly costly, since hundreds of thousands of firms and millions of consumers would have to be monitored. A deposit refund system would be far more cost-effective.[77]

3.3.2 Revenue-Neutral Carbon Tax

If the United States decides to participate in a binding, enforceable international agreement to reduce carbon emissions, policymakers will have to develop a mechanism to establish this country's pollution reduction commitment.[78] We suggest that such an agreement

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[76] There are significant administrative complications associated with such a program. Verification would be an important issue, as a deposit-refund system could encourage users to dilute solvents.

[77] For an examination of deposit refund systems and other incentive-based policy mechanisms for used lubricating oil, see Robert C. Anderson, Lisa A. Hoffman, and Michael Rusin, *The Use of Economic Incentive Mechanisms in Environmental Management*, Research Paper #051. Washington, D.C.: American Petroleum Institute, June 1990. See: Macauley, Molly K., Michael D. Bowes, and Karen L. Palmer. *Using Economic Incentives to Regulate Toxic Substances.* Washington, D.C.: Resources for the Future, 1992.

[78] For a detailed economic assessment of possible policy instruments to manage greenhouse gas emissions, see "An Economic Assessment of Policy Instruments To Combat Climate Change," Chapter 11 of the Report of Working Group III of the Intergovernmental Panel on Climate Change (IPCC), Geneva, Switzerland.

employ a revenue-neutral carbon tax (or another market-based instrument), rather than a strict command-and-control approach to dictate firm-by-firm reductions.

A properly designed carbon charge can enable the U.S. to cost-effectively achieve a national CO_2 target, by increasing the cost of CO_2 emissions (via a tax) and decreasing the cost of CO_2 sinks (via a tax credit). By altering price signals, a charge based on the carbon content of fuels, for example, can internalize the potential costs of climate change. Higher fossil fuel prices would both reduce demand for fossil fuels, thereby reducing emissions of carbon dioxide, and stimulate the development of new technologies that are less carbon intensive.

In contrast to using standards and other conventional regulatory approaches to reduce CO_2 emissions , a carbon-charge program could achieve a given target at a lower aggregate cost to society and at the same time, provide ongoing incentives for technological innovation.[79] A properly designed revenue-neutral tax policy charge, which combines the introduction of carbon charges and the reduction or elimination of other taxes, could help protect the environment by reducing CO_2 emissions, while reducing distortions associated with other taxes.[80] On the other hand, designing an acceptable mechanism to achieve revenue-neutrality is extremely complex.

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[79] For a more detailed discussion of a carbon charge see chapter IV in Reppeto, Robert et al.. *Green Fees: How a Tax Shift Can Work for the Environment and the Economy*. World Resources Institute, Nov. 1992.

[80] Likewise, the revenue raised by an auction of tradable permits could be used to finance a reduction in some (distortionary) tax (Goulder, Parry, and Burtraw 1996). As Fullerton and Metcalf (1996) note, the point is that some instruments (including those that raise and then refund revenues) do not create scarcity rents for the private sector that then become effective entry barriers. See: Goulder, Lawrence H., Ian W. H. Parry, and Dallas Burtraw. "Revenue-Raising vs. Other Approaches to Environmental Protection: The Critical Significance of Pre-Existing Tax Distortions." Paper presented at the National Bureau of Economic Research Workshop on Public Policy and the Environment, Cambridge, Massachusetts, 1996; and Fullerton, Don, and Gilbert Metcalf. "Environmental Regulation in a Second-Best World." Paper presented at the National Bureau of Economic Research Workshop on Public Policy and the Environment, Cambridge, Massachusetts, 1996.

A tradable permits program is another market-based instrument which would be more cost-effectively reduce CO_2 emissions than a command-and-control approach. But, there are important substantive differences between permit and charge programs that policymakers would need to consider prior to developing a permit-trading program in this context.[81]

3.4 Longer Term Issues

To date, market-based instruments have been applied only to new or reauthorized regulations, and only a small share of the existing body of regulation comes up for reauthorization in a given period of time. Consequently, the overall use of market-based instruments has been trivial. If cost-effective regulation is a serious priority for environmental policymakers, applications of market-based instruments to existing regulations must be aggressively pursued. While re-examining existing command-and-control regulations will be difficult to accomplish in the existing political climate, the growing support for reducing regulatory costs may make this avenue more approachable. Only in this manner will market-based instruments be an important part of future environmental policy.

The rewards for tackling this beast appear substantial. For example, in an experiment undertaken by Amoco and the EPA at Amoco’s Yorktown refinery, the regulators and the company found that more flexible approaches could yield a savings of 75 percent over existing command-and-control regulations.[82] Unfortunately, the savings from this experiment

[81] For a discussion of these differences, see Stavins, Robert N. and Bradley W. Whitehead. “Pollution Charges for Environmental Protection: A Policy Link Between Energy and Environment.” *Annual Review of Energy and the Environment* 17 (1992): p. 197-198.

[82] Schmitt, Ronalt et al. “The Amoco/EPA Yorktown Experiment.” Corporate Environmental Strategy, Vol. 1, No. 2 (1993): p. 7-12.

(potentially $40 million) will not be realized because the old regulations remain on the books. Similarly, the EPA has also been experimenting with Project XL, which seeks to work with industry groups across media (i.e., air, water, land) to revitalize environmental policy. Eight pilot programs are currently being launched and preliminary results look encouraging.[83] Most observers are skeptical that regulations can and will be achieved in a meaningful way but if they are, this could well be the greatest contribution of the next generation of environmental policy.

4. CONCLUSION

In spite of a history of false starts and unmet expectations, market-based instruments still remain an attractive tool for tackling environmental issues. After re-examining the potential cost-savings and positive societal impact market-based instruments offer, it is increasingly clear that they will need to be an integral part of the environmental landscape going forward. Policymakers and legislators must together develop creative applications for market-based instruments that will make them work.

Our proposed roadmap – improving program design, applying market-based instruments on the state level, and implementing federal market-based programs–will help the environmental community develop, apply and implement successful market-based programs. By shifting organizational mindsets, developing new and needed skills, and overcoming resistance of sometimes-competing interest groups, we can make market-based instruments work for our collective benefit and bring environmental policy into the 21st century.

[83] The pilot programs for Project XL are: Intel Corp., Anheuser-Busch companies, HADCO Corp., Merch & Co., AT&T Micro electronics, Minnesota Pollution Control Agency and California & South Coast Air Quality Management District. See: “Clinton, Gore say Project XL pilots are blueprints for regulatory reform“ BNA National Environment Daily, Nov. 7, 1995.August 16, 1996