

Crafting the Next Generation of Market-Based Environmental Tools

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THE STOCK MARKET—JOSE L. PELAEZ

The next generation of environmental policy will require innovative tools and strategies to meet both present and future challenges. Market-based instruments are one such tool. These instruments are by no means new. They have been part of the environmental policy landscape (though with varying degrees of prominence) for the past two decades because they are attractive in both theory and practice. But market-based instruments have generally failed to meet the great expectations that we have had for them. As a result, they now lie only on the periphery of environmental policy. Does this represent yet another breakdown between theory and practice? Was the effort to transform environmental regulations with these tools nothing more than tilting at windmills, and is it time to return to more established—if expensive—policy mechanisms?

A close analysis suggests that the answer is no. Market-based instruments have in fact produced attractive results and promise additional benefits. To date, their effectiveness

has been undermined by some unrealistic expectations, lack of political will, design flaws, and limitations in the ability of private companies to respond to them. These flaws are all remediable, however, and we may now be at a point where we can profit from past experience.

Rather than abandoning the use of market-based instruments, policymakers on all levels should direct their efforts to making the next generation of these instruments work better than the last one. By examining the use of market-based instruments and highlighting some of their flaws to date, this article will attempt to identify some of the ingredients required for these instruments to become a fundamental and effective part of the next generation of environmental policy.¹

Market-Based Policy Instruments

There are two steps in the formulation of an 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 selection of a mechanism for achieving it have important political ramifications. This article, however, will focus exclusively on the second step, assessing the use of market-based instruments to achieve given environmental goals.

Market-based instruments are regulatory devices that shape behavior through price signals rather than explicit instructions on pollution control levels or methods. These instruments, which include such measures

as tradable permits or pollution charges, are often described as "harnessing market forces" because, when properly implemented, they encourage firms and individuals to undertake actions that serve both their own financial interest and public policy goals.² (For additional information on the nature and scope of these instruments, see the box on this page.)

The conventional approach to regulating environmental quality is referred to as the "command-and-control" approach because it allows relatively little flexibility as to the means of achieving goals. Early environmental policy, embodied in such laws as the Clean Air Act of 1970 and the Clean Water Act of 1972, relied almost exclusively on this approach.³

In general, command-and-control regulations set uniform standards for firms, usually in the form of technol-

ogy or performance standards.⁴ As a result, such regulations force all firms to shoulder identical shares of the mitigation burden, regardless of the relative costs of this burden to them. This is a significant drawback because experience has shown that some firms can lower pollution at much less cost than others. Thus, while the command-and-control approach can effectively limit emissions of pollutants, it typically exacts unduly high societal costs in the process.⁵ Furthermore, command-and-control regulations tend to freeze the development of technologies that might otherwise result in greater levels of control. They offer little or no financial incentive for businesses to exceed their control targets, and both technology-based and performance-based standards have the effect of discouraging experimentation with new technologies.

TYPES OF MARKET-BASED INSTRUMENTS

Market-based instruments fall into five general categories, depending on whether they impose pollution charges, create tradable permit or deposit refund systems, or reduce market barriers or government subsidies.

Pollution charges consist of fees or taxes on the amount of pollution that a company produces, such as the amount of sulfur dioxide an electric utility emits in the process of generating electricity. By internalizing pollution costs, such charges encourage a company to reduce its pollution to the point where its marginal cost of mitigation equals the tax rate. Because the marginal cost of mitigation differs from firm to firm, however, not all firms will cut their pollution to the same degree. In general, those with lower costs will achieve greater reductions than those with higher costs, a result that will minimize the overall (societal) cost of mitigation.

The potential savings from such an approach to regulation are not just theoretical. Research indicates that control costs vary enormously as a result of differences in firms' physical configuration, age of assets, and so forth. By encouraging those firms with the lowest

costs to bear the brunt of the mitigation burden—as distinct from requiring all firms to reduce pollution by the same amount—society can realize substantial savings. The challenge with pollution charges is figuring out how high to set them. Ideally, the amount of the tax should equal the benefits from the cleanup. However, it is often difficult to know beforehand how firms will respond to a given level of charges—and thus what level of cleanup will result from a particular charge.

Tradable permits can achieve the same cost-minimizing allocation of the pollution control burden as charges while avoiding the problem of uncertain responses by firms. Under a tradable permit system, the government establishes an allowable (overall) level of pollution and then allots it among the various firms by issuing them permits. Firms that keep their emissions below the allotted level may sell or lease the unused portion of their permit to other firms or use it to offset excess emissions in other parts of their operations.

Under a *deposit refund system*, consumers pay a surcharge when purchasing a potentially polluting product.

When they later return the product to an approved center for recycling or proper disposal, their deposit is refunded. A number of states have successfully implemented this system through "bottle bills" to control litter from beverage containers and reduce the flow of solid waste to landfills.

Reducing market barriers imposed by government can also help to promote optimal resource use. For example, measures that facilitate the voluntary exchange of water rights promote more efficient allocation and use of scarce water supplies.

Elimination of government subsidies can also create a powerful economic incentive for environmental protection. Subsidies are the mirror image of taxes and, at least in theory, they could provide important economic incentives to address environmental problems. In practice, however, many subsidies promote inefficient and environmentally unsound economic development. A prime example is the below-cost sale of timber by the U.S. Forest Service to private companies, where the prices charged do not even cover the cost of preparing the timber for harvest.



U.S. ENVIRONMENTAL PROTECTION AGENCY—S. C. DELANEY

Traditional command-and-control regulation, which imposes uniform technology or performance standards on firms, offers little flexibility in meeting environmental goals.

Market-based instruments have captured the attention of environmental policymakers because of their potential advantages over the traditional command-and-control approach. The two most notable advantages are cost effectiveness and dynamic incentives for technology innovation and diffusion. In theory, properly designed market-based instruments allow society to achieve any desired level of pollution reduction at the lowest possible cost. (Alternatively, they offer more reduction for the same commitment of resources.) They accomplish this by allowing firms to share the burden of pollution control more efficiently—through encouraging those firms that can achieve reductions in pollution most cheaply to achieve the greatest reductions.⁶ In addition to this cost advantage, market-based instruments can provide stronger incentives for companies to adopt cheaper and better pollution-control technologies.⁷

Limited Experience

Market-based instruments have had some notable applications in the United States, Europe, and the rest of the world during the last two decades (see the box on pages 16 and 17 for an

overview of six applications in the United States.) Nonetheless, these instruments are still at the fringes of environmental policy and have generally not performed as well as predicted. Most importantly, they have not become a central component of private firms' environmental decisionmaking.

Market-based instruments represent only a small share of new regulations in the United States (and a trivial portion of existing ones). At the most basic level, there are two principal reasons for this. First, most of the major environmental legislation was enacted before such instruments became so prominent (since 1990, the Clean Air Act and the Safe Drinking Water Act are the only major environmental laws to be reauthorized). Second, Congress has generally lacked the political will to revise laws when not strictly necessary. Given that Title 40 of the *Code of Federal Regulations* (entitled "Protection of the Environment") contains more than 14,310 pages of environmental regulations, it could take a very long time for market-based instruments to become the core of environmental policy if Congress is not willing to use them for "old" problems as well as new ones.⁸

Compounding the problem, howev-

er, is the fact that many of those with a stake in regulatory outcomes have not embraced market-based instruments wholeheartedly. Although the federal government's environmental bureaucracy clearly desires effective environmental regulation, most Environmental Protection Agency (EPA) employees were hired to oversee traditional command-and-control programs requiring technical and legal skills. Because market-based regulation would require people with a different set of skills (notably economists and MBAs), current employees are naturally worried about becoming obsolete.⁹ For this reason, one would not expect them to focus on promoting market-based instruments to achieve environmental goals.

Efforts to increase the use of market-based instruments are sometimes hampered by environmental organizations as well. Although some environmental groups have welcomed the selective use of such instruments,¹⁰ others are concerned that increased flexibility in environmental regulation will lead to less protection overall. Furthermore, some in the environmental community still see environmental quality as an inalienable right that market-based programs curtail by condoning the "right to pollute." Lastly, some environmental professionals, like their government counterparts, may be resisting the depreciation of their skills.

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 the abstract because of their flexibility and cost effectiveness. For instance, in its landmark work *Changing Course*,¹¹ the Business Council for Sustainable Development described how economic instruments could be used to meet environmental objectives at reduced costs. As a practical matter, however, the vast majority of these businesses have not responded enthusiastically to

THE USE OF MARKET-BASED INSTRUMENTS IN THE UNITED STATES

There have been six major applications of market-based instruments in the United States above the local level: the U.S. Environmental Protection Agency's (EPA) emission trading program; a comparable trading program associated with the phasedown of lead in gasoline; water quality permit programs; a chlorofluorocarbon (CFC) permit program; a sulfur dioxide allowance system for acid rain control; and the RECLAIM program to improve air quality in the Los Angeles, California, metropolitan region.

EPA's Emission Trading Program

EPA began experimenting with emissions trading in 1974 as part of a Clean Air Act program to improve local air quality. Under this program, firms that reduce their emissions at certain facilities to a level below that required by law receive "credits" applicable against excessive emissions elsewhere. As a result, they are free to allocate their pollution control burden among different facilities so as to minimize overall compliance costs.¹ An "offset" program begun in 1976 goes even further, permitting firms that wish to establish new facilities in areas that are not in compliance with ambient air quality standards to offset new emissions by reducing existing ones (either internally or at other firms). In addition, a "banking" program permits firms to store emission credits for future use or sale to other firms.

Although EPA codified these programs in its emissions trading program in 1986,² they 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. Nevertheless, companies such as Amoco, DuPont, USX, and 3M have traded emissions credits, and a market for transfers has long since developed. Even this limited participation may have saved between \$5 billion and \$12 billion.

Lead Trading

The purpose of the lead trading program was to allow gasoline refiners greater flexibility in meeting emissions standards at a time when the lead content of gasoline was being phased down to 10 percent of its previous level. EPA

authorized the issue and trading of lead credits in 1982 and three years later initiated a program allowing refineries to bank such credits. Firms made extensive use of the program from 1985 to the end of 1987, when EPA terminated it because 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, the high level of trading activity suggests that the program was relatively cost effective. (Trading between firms far surpassed the levels observed in earlier programs, and in 1985, more than half of all U.S. refineries participated.) EPA estimated that the savings attributable to the program were 20 percent higher (\$250 million per year) than they would have been under a program that did not provide for banking.³

Water Quality Permit Trading

The United States has made relatively little use of tradable permit programs to control water pollution, particularly the non-point source pollution (mainly agricultural and urban runoff) that lies at the heart of the problem. An experimental program to protect Dillon Reservoir in Colorado demonstrates how tradable permits could be used to curb pollution of this nature.

Dillon Reservoir is the major source of water for the city of Denver. In the 1970s, nitrogen and phosphorus loading was threatening to make the reservoir eutrophic, even though point-source pollution from surrounding communities was being controlled to the standards of the best available technology. Rapid population growth and the resulting increase in urban runoff were simply overwhelming all efforts at control.

In 1984, Colorado officials developed a point/nonpoint source control program to reduce phosphorus flows. This program allowed publicly owned sewage treatment facilities to finance the control of nonpoint sources in lieu of upgrading their own treated effluents to drinking water standards. EPA estimated that the plan could save more than \$1 million a year due to the large differences in marginal control costs between nonpoint sources and sewage treatment facilities. However, no shifts in control efforts

ever occurred under the program, apparently because an increase in precipitation essentially eliminated the need for it.⁴

CFC Trading

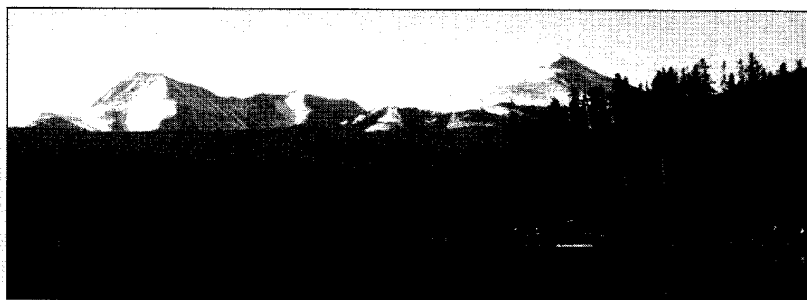
Tradable permits are being used by the United States to help comply with the Montreal Protocol, an international agreement aimed at preventing stratospheric ozone depletion by limiting the use of CFCs and related chemicals. Under this scheme, firms that wish to produce or use CFCs must have an "allowance" issued by EPA. (Because different CFCs have different effects on the ozone layer, each is assigned a weight that reflects its particular depletion potential.) These allowances are tradable.

By mid-1991, there were 34 participants in the market and 80 trades had been recorded. However, the overall efficiency of the market is difficult to determine because no studies have been conducted to estimate cost savings. The timetable for the phaseout of CFCs was subsequently accelerated and a tax on CFCs was introduced. As a result, it may be the tax that is responsible for the reduction in CFC production and use rather than the permit trading scheme. Nevertheless, the relatively low transaction costs associated with trading in CFC permits suggest that the system is fairly cost effective.

Sulfur Dioxide Allowances

A centerpiece of the Clean Air Act Amendments of 1990 is a tradable permit system that regulates sulfur dioxide emissions, the primary cause of acid rain. The act requires that total U.S. emissions of sulfur dioxide be reduced 10 million tons (from their 1980 level) and that emissions of nitrogen oxides be reduced 2 million tons. These reductions are to take place in two separate phases, the first beginning in 1995 and the second in 2000.⁵

To implement the first phase, EPA has assigned emissions limits to 111 electric utilities, allocating each utility a certain number of allowances based on its generating capacity plus bonus allowances available under a variety of special provisions.⁶ As of 1 January 1995, these utilities may emit more sulfur dioxide only if they qualify for an extension or



Dillon Reservoir in Colorado

purchase additional allowances from other utilities. In the second phase, which begins 1 January 2000, almost all electric power generating units in the United States will be brought within the allowance system. (Certain units are exempted to compensate for potential restrictions on growth and to reward units that are already unusually clean.) If the right to trade permits represents the system's carrot, its stick is a penalty of \$2,999 per ton for any emissions that exceed the year's allowance (and a requirement that such excesses be offset the following year).

A robust market in allowances has emerged, resulting in cost savings on the order of \$1 billion annually compared with the more conventional command-and-control regulatory approach. Nevertheless, the program has fallen short of predictions in terms of the number of permits traded and their price.⁷ But this may have more to do with faulty predictions than poor performance. Despite earlier concerns that state regulatory authorities would hamper trading to protect their own coal industries, preliminary evidence suggests that this has not been a major problem. Similarly, in contrast to early assertions that the structure of EPA's small permit auction market would cause problems, the evidence now indicates that this has had little or no effect on the vastly more important bilateral (firm-to-firm) market.

The RECLAIM Program

In January 1994, the South Coast Air Quality Management District, which is responsible for curbing air pollution in the Los Angeles area, launched a tradable permit program to reduce sulfur dioxide and nitrogen oxide emissions. As of June 1996, the 353 participants in this program, called the Regional Clean Air Incentives Market Program

(RECLAIM), have traded permits for more than 100,000 tons of emissions with a value in excess of \$10 million. Although RECLAIM currently covers only stationary sources that have emitted more than 4 tons of pollutants since 1990, authorities are considering expanding it to allow trading between stationary and mobile sources.⁸

1. See T. Tietenberg, *Emissions Trading: An Exercise in Reforming Pollution Policy* (Washington, D.C.: Resources for the Future, 1985); and R. W. Hahn, "Economic Prescriptions for Environmental Problems: How the Patient Followed the Doctor's Orders," *Journal of Economic Perspectives* 3 (1989): 95.

2. U.S. Environmental Protection Agency, "Emissions Trading Policy Statement," *Federal Register* 51 (4 December 1986): 43,814.

3. U.S. Environmental Protection Agency, *Costs and Benefits of Reducing Lead in Gasoline: Final Regulatory Impact Analysis* (Washington, D.C., 1985). See also R. Hahn and G. Hester, "Marketable Permits: Lessons for Theory and Practice," *Ecology Law Quarterly* 16 (1989): 361.

4. See Hahn, note 1 above; and Hahn and Hester, note 3 above.

5. For details, see B. L. Ferrall, "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.

6. Additional allowances were awarded to utilities that had installed scrubbers before the program began and to certain Midwestern utilities dependent on high-sulfur coal.

7. In 1990, EPA predicted that permits would sell for \$750 per ton (the marginal abatement cost for an average utility). At the end of 1995, however, these permits were trading privately for only about \$170 per ton and in an EPA auction administered by the Chicago Board of Trade in 1995, they went for only \$122 to \$140 per ton. For more on the program, see D. Burtraw, *Cost Savings sans Allowance Trades? Evaluating the SO₂ Emission Trading Program to Date*, Discussion Paper 95-30 (Washington, D.C.: Resources for the Future, 1995).

8. For more details, see R. A. Wegman et al., *The Environment Goes to Market: The Implementation of Economic Incentives for Pollution Control* (Washington, D.C.: National Academy of Public Administration, 1994), chapter 2.

these market-based 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. On the basis of past experience, they tend to believe that political forces beyond their control might unfavorably distort the design and implementation of market-based instruments. Their first concern is that any cost savings will be taken away from them and simply used to increase the overall level of environmental cleanup. As one business representative noted, "These instruments are often seen as a way to up the ante."¹² Second, businesses fear that the actual design of these instruments will lessen their flexibility and penalize companies. For instance, in implementing regulations to reduce sulfur dioxide emissions, several states that produce high-sulfur coal attempted to force companies to install expensive scrubbers instead of shifting to more economical low-sulfur coal.

A third factor dampening businesses' enthusiasm for market-based instruments is the fear that the rules will change over time. Environmental investments can be very costly, running into tens of millions of dollars. For businesses to get optimal return from these investments, environmental regulations have to be not only flexible but predictable over time. Many business leaders are skeptical that any presidential administration can "deliver the government" in the necessary way. Acid rain furnishes a good example: In that case, EPA proposed changes to the permit bidding process after it was underway. Furthermore, the American Lung Association has sued EPA in an attempt to force the agency to tighten standards for sulfur dioxide emissions.¹³ Whether or not such measures are desirable for environmental reasons, they represent a potentially significant change in the rules of the game for companies who invested under different assumptions.

Given the antiregulation climate per-



Tradable permits have great potential to improve water quality at minimal cost.

vading Washington, firms have been successful in arguing against *any* regulation rather than for *better* regulation. To the extent that environmentally sensitive industries have felt compelled to act, they have preferred voluntary to compulsory approaches. The chemical industry, for example, has developed its Responsible Care codes and argues that this obviates the need for intensive regulation. The petroleum and paper industries have established similar initiatives. The success of these programs—or at least the energy being directed toward them—may have diverted some attention away from market-based approaches, however.¹⁴

Finally, firms are concerned that “buying the right to pollute” under emissions trading programs could lead to negative publicity. Even though purchasing emissions permits is completely legal and helps to improve the environment at a lower overall cost to society, uninformed citizens may perceive such behavior as unethical.

Lack of public understanding is another reason for the slow penetration of market-based instruments into environmental policies. Unfortunately,

the benefits of such instruments are typically not visible while the perceived negatives are. Under traditional command-and-control policies, the costs of compliance are usually buried within a firm's capital and cost structure. While consumers may see prices go up, they tend not to associate this with environmental regulations. By the same token, they do not experience firsthand the cost effectiveness of market-based instruments: It is simply not readily apparent to consumers that gasoline or electricity

prices are lower than they otherwise would have been because of the implementation of market-based programs to phase out lead or reduce sulfur dioxide emissions.

Moreover, market-based instruments (especially charges) may suffer from making environmental costs more transparent. While it may be valuable to encourage individuals to consciously link environmental costs and benefits, it can also dampen the enthusiasm with which they embrace market-based instruments. Finally, these instruments are an easy target for opponents because they conjure up images of companies simply paying for the right to pollute. While the fallacy of this view is unquestionable (after all, command-and-control instruments just *give away* the right to pollute), the public relations imagery surrounding it has been compelling.

Mixed Performance

As noted previously, market-based instruments have tended not to perform as well as predicted. One of the reasons for this is that the predictions themselves have often been unrealis-

tic. They have generally been based on performance under ideal conditions, implicitly assuming that the cost-minimizing allocation of the pollution-control burden would result and that marginal abatement costs would be perfectly equated across all sources.¹⁵ This has tended to distort comparisons between market-based and other approaches. In a frequently cited table, for instance, one analyst compared the cost of an actual command-and-control program to that of a least-cost market-based program.¹⁶ Others have mistakenly used this comparison as an indicator of the potential gains from specific market-based instruments. (The 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, such as the transaction costs involved in implementing market-based programs; uncertainty as to the property rights bestowed under these programs; competitive market conditions; an existing regulatory environment that does not give firms appropriate incentives to participate; and the inability of firms to fully take advantage of program opportunities because of flaws in their internal decisionmaking processes.¹⁷

The sulfur dioxide allowance trading program is a high-profile example of a case where overly optimistic predictions were made. Analysts originally predicted that the program would cut the cost of achieving emissions reductions by up to \$3 billion annually.¹⁸ Now, however, the program is expected to result in savings of only about \$1 billion annually.¹⁹ Furthermore, the volume of permit trading and the prices paid for permits have been lower than originally predicted. In a correctly functioning market, one would expect the price of a permit to equal the marginal cost of lowering emissions. One reason for the lower

than expected permit prices is simply that marginal abatement costs have declined due to a fall in the price of low-sulfur coal and innovations in fuel blending that have enabled more switching to that type of coal.²⁰ Permit prices may actually be lower than marginal abatement costs, however, owing to utilities' reluctance to consider new options; constraints imposed on them by existing contracts; the existing regulatory environment, including locally binding environmental and rate-of-return regulations; regulatory uncertainty; property rights questions; and transaction costs.²¹

Flaws in the design of market-based instruments have also contributed to their failure to perform at full potential. While some of these flaws were simply due to ignorance as to how markets would react, others were known to be problematic from the start but nevertheless included to make the programs politically palatable. One striking example is the "20 percent rule" under EPA's Emission Trading Program. This rule, which was adopted at the insistence of the environmental community, stipulated that each time a permit was traded the amount of pollution it authorized was to be reduced 20 percent. Because traded permits became progressively less valuable under this rule, it discouraged trading and thereby increased regulatory costs.

A third explanation for the mixed performance of market-based instruments lies in the limitations imposed by firms' internal structures and the expertise of their management. Market-based instruments entail very different kinds of decisions than do more traditional regulatory approaches, and most firms are simply not equipped to make them. Because market-based instruments have not been widely used and business is uncertain as to how great a role they will play in the future, most companies have not reorganized their environmental, health, and safety (EH&S) departments to fully exploit these instruments. To the contrary,

most firms continue to focus on minimizing the cost of complying with traditional regulations rather than making the strategic decisions required by market-based instruments.

There are exceptions, of course. Enron Corporation, a multinational energy company based in Texas, has attempted to use market-based instruments to its strategic benefit by creating new markets for acid rain permits. Other firms have appointed EH&S leaders who are familiar with a wide range of policy instruments and who bring a strategic focus to their pollution-control efforts. Generally, however, as lawyers and engineers rather than MBAs, EH&S personnel are more experienced in interpreting detailed regulations and designing technological solutions to comply with them than they are in exploiting the competitive advantages that market-based instruments allow.

EH&S departments are further impaired because their functions are not well integrated with those of the business units. Close links between the two functions are rare and, in many cases, environmental costs are not fully measured or attributed to the business units from which they derive. This has limited companies' ability to make the few strategic decisions required under command-and-control regulation (such as allocating production among different plants to minimize the costs of compliance). When companies face the much broader set of strategic questions raised by market-based instruments, the lack of integration of EH&S units with business units becomes a more pressing problem.

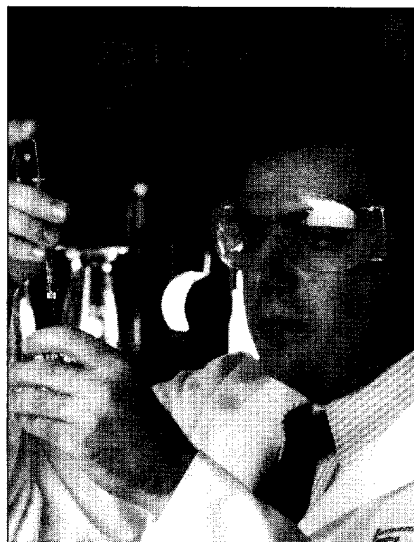
Furthermore, EH&S managers have traditionally been responsible mainly for risk management and problem avoidance. Seldom have they had real incentives to improve the bottom line. While business managers may try to push for more cost-effective environmental solutions, they often lack the knowledge (and confidence) to take on the technical experts. The firms that

have been most effective in addressing these issues have moved their general managers through the EH&S department 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 will not be realized.

The Next Generation

Given the relatively poor performance of market-based instruments so far, one might argue that they should be dropped from the regulatory toolkit. On the contrary, both the success with these instruments and the lessons learned from their failures suggest that we use them even more in the future.

At the beginning of the 1990s, EPA estimated that the United States was



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EH&S departments need to play a greater role in firms' strategic decisions.

spending more than \$100 billion annually to comply with some federal environmental laws and regulations—an amount that is likely to rise over time.²² As a result, environmental policymakers need to seek more cost-effective tools for maintaining and improving environmental quality. This means that market-based instruments, with their potential for reducing costs

and providing incentives for new technology, are more important than ever. When used with other policy options, these instruments can play an exceptionally valuable role in helping society meet its overall environmental goals with minimum economic sacrifice. Making the best use of resources is especially important because we have other pressing social problems to address, including poverty, education, and violent crime.

Based on our experience with the current generation of market-based instruments, there appear to be four steps we could take to ensure that more such instruments are adopted and to realize greater benefits from them: improving their design; using them more at the state and local level; implementing a deposit refund system for hazardous wastes and a revenue-

As noted previously, firms and environmental groups are both concerned about the lack of predictability associated with most market-based instruments—firms fearing that the rules of the game will be changed in mid-stream and environmental groups that flexible instruments will lead to less pollution control. The first step toward addressing such concerns should be to clarify precisely when market-based instruments are appropriate. Such instruments are not a panacea for all environmental problems but only one element of what should be a portfolio of policy instruments. In some cases, market forces alone may be sufficient to address an environmental problem (such as when consumers change their purchasing behavior after learning about its adverse environmental impacts). This, of course, is attractive

because it avoids cumbersome rulemaking and monitoring. On the other hand, it may require the government to make sure that the public has the information it needs to make well-informed decisions (as it has done with the Toxics Release Inventory and various labeling laws).²³ In other cases, the government may be able to negotiate an agreement with companies or industry groups to avoid direct

regulation. When regulation is called for, however, market-based instruments should be the first option considered—even though many environmental problems will continue to require a traditional command-and-control solution.

When implementing market-based instruments, an overarching goal should be to make them more predictable in terms of being permanent, having set rules, and ensuring that pollution control targets are met. In addition,

market-based instruments should be designed to deliver optimum benefits through reducing transaction costs; clarifying the rights bestowed on participants; ensuring competitive market conditions; offering incentives to participate; and providing sufficient information to program participants. When political pressures necessitate changes in a proposed program, they should be made so as not to detract from the program's efficiency. For example, the environmental community's goal of increasing the amount of pollution control achieved by EPA's emissions trading program could have been met more effectively if the 20 percent 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 percent) over a designated period of time. This would not have diminished the program's antipollution impact, but by avoiding a disincentive to permit trading, it would have lowered the overall costs of regulatory compliance.

State and Local Efforts

In the current political climate, where power continues to be transferred from the federal government to the states, it is essential that state and local governments give greater emphasis to market-based instruments. Although federal spending for environmental control continues to outpace state spending (\$18.2 billion in 1991, compared with \$9.6 billion), state spending has been increasing while federal spending has been decreasing.²⁴ As a result, the discussion regarding market-based instruments has begun to shift from federal initiatives to those at lower levels.

One of the most exciting uses of market-based instruments at the state and local level has been in an area not generally regarded as environmental: the permitting process. The time required to issue permits pertaining to

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TOM STACK & ASSOCIATES—GREG VAUGHN

Unit pricing is an effective way to encourage households to recycle.

neutral carbon tax at the federal level; and changing the current regulatory structure to make greater use of market-based instruments.

Design Improvements

Improving the design of market-based instruments should help overcome the resistance that firms and environmental groups have shown toward them as well as ensure that more of their potential benefits are actually realized.

Environmental Tools

(continued from page 20)

such matters as zoning, construction, and pollution discharge has been a great challenge for state and local governments—and a source of frustration for new and growing companies. Some states offer specific incentives (usually in the form of shorter delays) for firms to participate in new pollution prevention programs.²⁵ While not market-based instruments in the strict sense, initiatives of this sort do embody the spirit of what is called for in the next generation of environmental policy. That is, they offer a relatively simple way to meet environmental

Market-based instruments can be used to ensure that waste creation and disposal decisions are more closely linked to the actual costs.

Some municipalities have highlighted the costs of waste disposal by including a separate charge for waste collection in their property tax assessments. However, because such charges are usually flat fees that do not vary with the quantity of waste, they provide no incentive for households, firms, and other organizations to modify their product purchasing and disposal decisions.

Fundamental to an effective waste management strategy is getting the prices right. Unit pricing is an attractive way to address this problem.

By charging households for waste collection services in proportion to the actual amount of refuse that they leave at the curbside, unit pricing can link household charges to the real costs of collection and disposal. This method creates a strong incentive for households to reduce the quantity of waste they generate, whether through changes in their purchasing patterns, reuse of

products and containers, or composting of yard wastes. Furthermore, by charging higher rates for unseparated refuse than for certain separated recyclables, local governments can create incentives for households to recycle parts of their trash. In addition to encouraging reductions in the solid waste flow, unit pricing provides flexibility to consumers and producers.

Municipalities that use unit pricing for collection and disposal services need to consider several important design and implementation issues. For instance, in some of the initial forays into unit pricing, several communities

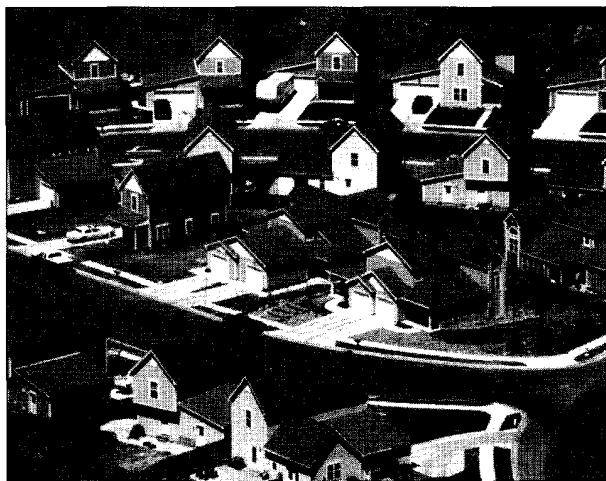
(including Seattle) billed households for the number and size of trash receptacles they left at the curbside. Although this led to a substantial reduction in the flow of solid waste into landfills, it also raised fairness concerns because low-income households were paying a higher percentage of their incomes for trash pickup than high-income households. Seattle addressed this issue much as electric utilities do—with low “life-line rates” for initial blocks of usage.

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 to them.

Land use. Increasingly, acrimonious public debates about economic growth versus environmental protection are centered on land-use decisions. And as economic and population growth continue, a larger share of environmental problems will entail tensions over the ways in which land is used. Market-based instruments have been employed to a limited extent in this area, and the opportunity may exist to widen their application.

Land trading systems, which are a type of 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. It allows the state and five local water management districts to license wetlands owners who preserve (or improve) their property as “mitigation bankers” entitled to sell “credits” to developers.²⁷ The amount of mitigation credits required to offset a development is based on the type of land that is to be developed. Even before the program was formally established, a group of entrepreneurs created a company called Florida Wetlandsbank, which now sells mitigation credits for \$45,000 per acre and uses a portion of the proceeds to improve degraded wetlands.

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Local governments can use the permitting process to foster environmentally benign land use.

goals without intricate legislation. There is also ample opportunity for state and local governments to use market-based instruments to address environmental issues in areas such as waste management, land use, and air quality.²⁶

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. In most communities, the costs of waste collection and disposal are not generally known because they are embedded in property or other taxes.

Programs of this sort clearly come with complex implementation issues to be resolved. Devising methods to compare different types of land along such dimensions as their level of biodiversity, for instance, is a significant challenge. Nonetheless, market-based solutions have the potential to reduce the degree of conflict usually associated with such development decisions.

Air quality. Building on the much discussed RECLAIM trading program that the city of Los Angeles implemented in 1994, several states have launched (or are in the process of launching) their own air emissions trading programs.²⁸ To be successful, these programs must incorporate the policy lessons we have learned from previous experiences with market-based instruments. Several are already in danger. One of these is Michigan's emissions trading program, which allows companies that exceed current regulatory requirements for volatile organic compounds (VOCs) and all other localized air pollutants except ozone to sell emissions credits to other companies.²⁹ Although the program took effect in March 1996, it has yet to be approved by EPA due to administrative delays and concerns over the program's ability to meet regulatory control standards. Uncertainty as to whether the current rules will be the final ones is likely to dampen firms' enthusiasm for the program. As other emissions trading programs are instituted, such as New Jersey's program for nitrogen oxides and VOCs and Connecticut's program to authorize trading of New Jersey's emissions credits, officials must ensure that they are designed to encourage maximum participation.³⁰

Federal Efforts

While working to further the use of market-based instruments at the state and local level, policymakers should also push for new incentive programs at the federal level, particularly a deposit refund system for hazardous wastes and a revenue-neutral carbon



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Lead-acid batteries are an excellent candidate for a federal deposit refund program because of the high environmental costs of improper disposal.

tax (to reduce carbon emissions when and if the United States decides to participate in a binding world agreement).

Hazardous wastes. While unit pricing for municipal waste is useful in reducing the amount of waste created, it does not provide incentives for changing disposal methods, a problem that is particularly important in the case of hazardous wastes. Deposit refund systems can create these incentives. These systems combine a special front-end charge (the deposit) with a refund payable when the substance in question is turned in for recycling or proper disposal. (This, of course, is the concept behind the "bottle bills" that many states have adopted.) Although deposit refund systems have been used primarily at the state level, federal programs would be preferable in certain cases, such as when firms sell easily transportable products throughout the country 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 appropriate for products for which the costs of improper disposal are high; in

such cases, the benefits from proper disposal usually outweigh the costs of separation and redemption. One product for which a federal deposit refund system should be considered is lead-acid batteries. The amount of lead going into landfills and incinerators is a major hazard, particularly in view of the well-documented linkage between lead exposure and childhood learning disabilities.³¹ Most of the new lead entering the environment each year is from the improper disposal of batteries. Although a substantial amount of lead from motor vehicle batteries is recycled each year, the proportion of batteries recycled has been decreasing during the last 30 years. At present, more than 20 million unrecycled batteries enter the waste stream annually and this number may increase by more than 30 percent by the year 2000.³²

In addition to the lead-acid battery deposit program, the federal government should consider creating a deposit refund system for certain "containerizable" hazardous chemicals (largely liquid chemicals stored in metal drums). About 30 percent of industrial wastes are generated in small enough quantities to be containerized. One important category of such chemicals is chlorinated solvents.

While most chlorinated solvents are recycled to some degree by the thousands of firms using them, substantial amounts still reach the environment. Especially serious are the highly contaminated spent solvents that are uneconomical to recycle and that are often illegally dumped to avoid disposal costs.

Another potential application of the deposit refund approach is to used lubricating oil. The improper disposal of such oil, which current federal regulations do not address, is both a health and an ecological hazard. When used oil is dumped into storm sewers or placed in unsecured landfills, it can contaminate groundwater and surface water supplies; when it is burned as fuel it produces air pollution. Enforcing proper disposal of lubricating oil through conventional regulations would be exceedingly costly because hundreds of thousands of firms and millions of consumers would have to be monitored. A deposit refund system would be far more cost effective.³³

Carbon emissions. If the United States does decide to participate in a binding international agreement to reduce carbon emissions, policymakers will then have to devise a mechanism to meet this country's pollution reduction commitment.³⁴ This would be easiest to accomplish by means of a revenue-neutral carbon tax (or other market-based instrument) rather than through the traditional command-and-control regulation.

A properly designed carbon tax regime would both increase the cost of carbon emissions (by imposing a tax, say, on the carbon content of fuels) and decrease the cost of creating or preserving carbon sinks (by allowing a tax credit for such activities). By altering the relevant price signals, such a regime would internalize the costs of climate change for both firms and individuals. Higher relative prices for fossil fuels would have the effect of both reducing carbon emissions and stimulating the development of new technologies that are less carbon

intensive. This would enable the United States to achieve its emissions reductions goals at the lowest overall cost.³⁵

A properly designed carbon tax regime would also be revenue neutral, that is, it would combine the introduction of carbon charges with the reduction or elimination of other taxes, thus helping to reduce the distortions associated with those taxes.³⁶ Designing an acceptable mechanism to achieve revenue neutrality is extremely complex, however.

Tradable permits are another market-based approach to reducing carbon emissions that is more cost effective than a traditional command-and-control approach. There are, however, important substantive differences between permit and tax programs that policymakers would need to consider prior to developing a permit-trading program.³⁷

Regulatory Structure

To date, market-based instruments have been adopted only in conjunction with new or reauthorized regulations. Because only a small percentage of the existing body of regulations comes up for renewal at any given time, the overall use of market-based instruments has been fairly small. If cost-effective regulation is a serious priority for environmental policymakers, the application of market-based instruments to existing regulations will have to be aggressively pursued. While reexamining existing regulations will be difficult in the current political climate, the growing support for reducing regulatory costs may make this avenue more viable. Only in this way will market-based instruments become an important part of future environmental policy.

The rewards for tackling the regulatory beast appear to be substantial. For example, an experiment conducted by Amoco Oil Company and EPA at Amoco's Yorktown, Virginia, refinery showed that more flexible approaches could yield a savings of 75 percent

(\$40 million) over existing regulations.³⁸ Unfortunately, these savings will not be realized because the old regulations remain on the books. EPA has also been experimenting with Project XL, which seeks to work with industry groups across media (air, water, and land) to revitalize environmental policy. Eight pilot programs have recently been launched and preliminary results are encouraging.³⁹ Most observers are skeptical that such cooperative programs will achieve meaningful results, but if they do they could well be the hallmark of the next generation of environmental policy.

Final Thoughts

In spite of a history of false starts and unmet expectations, market-based instruments remain an attractive tool for tackling environmental problems. Given the potential cost savings and positive societal impacts that such instruments offer, they should clearly be an integral part of the environmental policy landscape in the future. For this reason, policymakers and legislators need to work together to develop effective applications for them.

The roadmap laid out in this article—improving program design, applying market-based instruments at the state and local level, implementing new federal programs, and changing the basic approach to regulation—will help the environmental community develop and implement successful market-based regulation. By shifting organizational mindsets, developing new and needed skills, and overcoming the 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.


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- Technology-based standards specify the method (and in some cases the actual equipment) that firms must employ to meet a given environmental goal. For example, all electric utilities may be required to use a certain type of scrubber to remove particulates. Performance-based standards, by contrast, set uniform control targets for firms but allow them some latitude as to how they meet those targets.
- One survey of eight empirical studies of air pollution control strategies found that the costs associated with the command-and-control approach exceeded least-cost benchmarks by factors ranging from 1.07 (for sulfate emissions in the Los Angeles area) to 22 (for hydrocarbon emissions at all of DuPont's U.S. plants). See T. Tietenberg, *Emissions Trading: An Exercise in Reforming Pollution Policy* (Washington, D.C.: Resources for the Future, 1985).
- Market-based instruments are optimal (in the classic economic sense) because they equalize firms' marginal costs of reducing pollution. A firm's marginal, or incremental, cost is the additional expense it incurs in achieving an additional amount of pollution reduction. If marginal costs are not equal for all firms, the same level of pollution control could be achieved at lower overall cost simply by allocating more of the burden to firms with lower unit costs.
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