TRADABLE EMISSIONS

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Abstract

Tradable emissions have proven to be an efficient market-based tool for reducing the cost of pollution control. Exchanging emissions in competitive markets with low transactions costs can be used as a way of finding the lowest cost points of abatement in an industry or geographical region. The Congress used this approach in creating tradable sulfur dioxide allowances in the Clean Air Act Amendments of 1990 to reduce the cost of acid rain control, a policy which has demonstrated great success. New pollution control policies would benefit from the use of tradable emissions as a method of reducing a national abatement cost already estimated at over $100 billion.

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INTRODUCTION

Policy makers are beginning to discover the value of markets as a tool in the protection of public health and the environment. As larger and more costly environmental problems are addressed, "tradable emissions," which allow holders to emit specific amounts of pollutants, are increasingly recognized as an efficient way of enabling regulated entities as a group to seek the lowest cost of reducing pollution. There are a number of opportunities in the environmental regulation field to employ the concept of tradable emissions, particularly in those areas where higher standards are necessary or where current regulatory practices have not produced the expected reduction in pollution. Successful examples are found in the regulation of both air and water pollution. Tradable emissions provide a useful mechanism for reducing what is estimated to be a current national pollution abatement cost of more than $100 billion. [1]

A tradable emissions system is based on the principle that the cost of emissions reductions varies from facility to facility. When each facility is given a limit on its emissions by the regulators, some facilities may be able to reduce emissions more than required at a fairly low cost. Those which can may choose to reduce emissions levels below the required levels and sell the differential to another source facing a higher cost of reducing its pollution. If the market price of these extra emissions entitlements is higher than the cost of reducing emissions at a given facility, then there is an incentive to make further reductions and sell these entitlements.

In the near future, two air pollution problems might be addressed with the aid of this market-based tool. Under the Clean Air Act, particulate matter and ozone are pollutants for which higher standards are under consideration and for which reduced costs might mean the difference in achieving the new goals. Internationally, negotiations are underway to reduce the worldwide emissions of carbon dioxide and other gases due to their role in increasing global temperatures, commonly known as the "greenhouse effect." Several nations, including the United States, are prepared to recommend tradable emissions as a tool to reduce the worldwide cost of any initiative which may result from these negotiations.

Over the last 50 years, environmental regulators have prescribed specific methodologies for pollution reduction by an approach known as "command and control." This approach requires government regulators to make a judgment as to the best technological solution to a pollution problem or to specify a level of emissions reductions for each plant, despite variations among

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[1] U.S. General Accounting Office, *Regulatory Reform: Information on Costs, Cost-Effectiveness, and Mandated Deadlines for Regulations*, March 1995, p. 4.

plants in adaptive capacity and the cost of reducing emissions. Command and control is a heavy-handed and cumbersome form of regulation. The resulting loss in scarce resources, higher consumer costs, and elimination of jobs reduce the growth rate of the economy. On the other hand, tradable emissions allow more flexibility in the selection of specific reduction measures. They take advantage of a plant manager's understanding of his facility and the best options for reducing emissions at lower cost. Lower costs for firms mean lower costs for consumers.

While trading emissions in the market provides some flexibility in how firms deal with the emissions limitations, the important issue from an environmental protection viewpoint is that overall limitations on pollution have been established. A regulatory framework is first established to define the total limit for emission of a pollutant. Then an allocation scheme divides this total among various entities--through grandfathering, auctioning, or some other formula. As long as the ceiling for emissions is not violated, how the total permissible amount is eventually distributed among firms by the market is not a major issue. [2]

TRADABLE ALLOWANCES IN SULFUR DIOXIDE

The Acid Rain Title of the Clean Air Act Amendments of 1990 was the first major legislative effort to deal with a large and continuing problem with the assistance of tradable emissions "allowances." It redesigned the Federal approach to solving the problem of sulfur dioxide emissions. Sulfur dioxide is deposited into the air mainly by fossil fuel-burning electric power plants and is a major contributor to the problem of acid rain. Prior efforts to deal with the problem were unsuccessful, in part because the Clean Air Act, like many environmental protection regulations, assumed that the government could specify a technical solution for every source of pollution. In the case of fossil fuel power plants, the solution proposed was to require higher standards for new plants, which was believed to be cheaper than requiring expensive modifications to existing facilities. But this policy and other factors encouraged utilities to keep plants in service beyond their normal life spans, so sulfur dioxide reduction goals were not met.

One objective of the 1990 Amendments was to reduce sulfur dioxide emissions from utilities by 8.5 million tons below 1980 levels by the year 2000. To accomplish this, electric utility plants above a certain size were given an initial allocation of emissions allowances for sulfur dioxide based on historical patterns. Each allowance permits a generating unit to emit one ton of sulfur dioxide in the year in which the allowance was issued or in succeeding years. Emissions levels below these initial allocations mean that a generating unit has a surplus of allowances which might be sold to another unit to cover its emissions above the initial allocation. The method used to achieve reductions is not specified. The only requirement is that each generating plant owns allowances sufficient to cover the amount of its emissions. This approach

[2] In circumstances where hot spots may occur due to a geographical concentration of emissions sources, limitations may be placed on some trades.

offers financial incentives to reduce emissions beyond some level specified by regulators. Units that exceed the level of emissions for which they hold allowances are penalized at a rate in excess of the cost of compliance and are required to purchase the necessary allowances after the fact.[3]

The program is divided into two phases. The first phase began on January 1, 1995, and covered 110 of the largest utility generating plants. The second begins on January 1, 2000 and will cover almost all generating plants. Owners of new generating plants are required to buy allowances in the market or purchase them from a reserve auctioned off by the U.S. Environmental Protection Agency (USEPA). By requiring the new units to acquire allowances from the initial allocation, no net increase in emissions is caused by the addition of those units.

CRITERIA FOR A SUCCESSFUL MARKET

Although some aspects of Federal policy as currently conducted might benefit from changes, the sulfur dioxide allowance program has been generally successful in lowering the cost of emissions reduction. The key conditions for a successful market in tradable emissions are discussed below in the context of this program.

CLEARLY DEFINED PROPERTY RIGHTS

From an economic perspective, pollution problems are caused by a lack of clearly defined and enforced property rights. Smokestack emissions, for example, are deposited into the air because the air is often treated as a common good, available for all to use as they please, even as a disposal site. Not surprisingly, this apparently free good is overused. A primary and appropriate role for government in supporting the market economy is the definition and enforcement of property rights. Defining rights for use of the atmosphere, lakes, and rivers is critical to prevent their overuse. Once legal entitlement has been established, markets can be employed to exchange these rights as a means of improving economic efficiency. For the market system to function efficiently, however, the market should be competitive and transaction costs should be low.[4]

Establishing ownership rights is the first step in taking advantage of market efficiencies. Without a clear definition of ownership, exchange will be difficult. Likewise, these property rights will be of low value unless they are enforced by the government. Often, what should be

[3] The availability of sophisticated technology permits the continuous monitoring of emissions.

[4] Ronald Coase is the economist most closely associated with the concept of employing a clear definition of property rights and permitting their exchange in a competitive market as the most efficient way of dealing with the problem of external costs. See his "The Problem of Social Cost," *Journal of Law and Economics*, 3, October 1960, pp. 1-44.

clearly defined and enforced rights are vaguely defined in practice, and their owners are sometimes at the mercy of independent judges who may not enforce them.

Clear establishment of entitlements is the first step. For example, since tradable sulfur dioxide allowances were created by Federal legislation, the value of these legal entitlements has a firmer foundation than if they had been created by an administrative rule. The 1990 Clean Air Act Amendments carefully built the framework of regulation, describing the trading allowance program in greater detail than is typical in the Clean Air Act, leaving little to the discretion of regulators. This specificity reduced the opportunity for litigation which might hurt the soundness of these entitlements. They are also less encumbered because the USEPA, which maintains the records of trades, does not review the trades for approval. Nevertheless, existing environmental protection standards, such as those contained in state implementation plans developed under the Clean Air Act, continue in force.[5]

In addition, for a tradable emissions program to work, not only must the regulatory authorities have confidence in their ability to monitor actual emissions, but the market participants must also have confidence that their investment in emissions rights is protected from cheating by emissions sources. In the case of sulfur dioxide emissions allowances, the availability of continuous monitoring technology and the limited number stationary emissions sources have provided this assurance.

The actual method employed for dividing up the total allocation of emissions is irrelevant to making a tradable emissions market successful. The issue is market efficiency in the allocation of resources, not equity in the initial allocation of property rights. It makes no difference to the market's efficiency as to whom the tradable rights are assigned initially. One of the fundamentals central to economic theory is that a competitive market will reallocate resources to their highest valued use, regardless of the original distribution. In the case of the sulfur dioxide emissions allowances, the initial allocation was based on each generating unit's past record of fuel use and limitation on emissions.

LOW TRANSACTION COSTS

Efficiency in resource allocation also requires relatively low transaction costs. Transaction costs include those costs necessary to identify a trading partner, make proposals, execute negotiations, and ensure the completion of obligations under any resulting contract. Transaction costs are dependent on the volume and frequency of transactions because economies of scale will reduce transaction costs for frequent exchanges or large numbers of allowances. The acceptable magnitude of transaction costs that will permit market exchanges is dependent on the relative advantage of making the exchange. Greater variation in savings potential among plants will

[5] A. Nancy Kete, "The Politics of Markets: The Acid Rain Control Policy in the 1990 Clean Air Act Amendments." (Doctoral Dissertation, Johns Hopkins University, 1992.)

accommodate higher transaction costs. Little differential, on the other hand, means less incentive to trade, even if transaction costs are relatively low.

Government can assist in developing markets by reducing transaction costs, for example, by recording and reporting exchange prices. Regulators can ensure that transfers are effective as quickly as possible, with a minimal burden on the parties involved in the transfer. [6] For example, in the report accompanying the Clean Air Act Amendments of 1990, the Congress urged USEPA to avoid unduly restricting the types of legal arrangements by which parties could exchange allowances, including leases, sales, and bartering.

One area where USEPA has unnecessarily increased transaction costs has been in the conduct of allowance auctions. Congress permitted the USEPA to withhold a certain number of allowances against the possibility that utility companies might hoard allowances. Each year the USEPA auctions these allowances in a process whereby the winning bidders pay the price they bid, which results in multiple prices rather than one market-clearing price resulting from an iterative process. Multiple prices raise the cost of understanding what future bid and offer prices might be. One market-clearing price would be a better solution for providing information about supply and demand.[7]

COMPETITION

Efficiency in the allocation of emissions rights can be achieved in the ideal case only when the market is competitive. There must be many buyers and sellers, and they must have full information about prices and quantities available to them. Furthermore, no one buyer or seller should dominate the market and independently influence the market price. The extent to which these conditions exist will determine the degree of efficiency with which the market produces an allocation of resources. With the 1990 Clean Air Act Amendments, the Congress made clear that the USEPA should encourage a competitive market for sulfur dioxide emissions allowances. It instructed the USEPA Administrator to support the widest potential ownership of allowances, to include ownership by brokers, investors, and other possible market participants.

ADVANTAGES OF SULFUR DIOXIDE EMISSIONS ALLOWANCES

The advantages of a tradable allowances policy over a command-and-control approach are best demonstrated by the response of utilities and related industries to the restrictions on sulfur dioxide emissions required after 1995. In general, tradable allowances in sulfur dioxide have

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[6] United States Senate, Committee on Environment and Public Works, *Report Accompanying S. 1620,* (S. Rept. 101-228), 101st Cong., 2d sess., p. 320.

[7] U.S. General Accounting Office, *Air Pollution: Allowance Trading Offers an Opportunity to Reduce Emissions at Less Cost*, December 1994, p. 54.

lowered the overall cost of compliance by having the market find the lowest cost in the industry. Utility generating plants capable of reducing emissions at less cost--because of location, technology, age, or other factors--generate surplus allowances for sale or future uses when standards are higher. In theory, these plants will reduce emissions to the point where the rising cost of reductions would equal, per ton, the market price for tradable allowances.

An important result of the market for tradable allowances in sulfur dioxide has been the competition among various purveyors of low-emissions solutions. Among the options available to utilities are scrubbers, low-sulfur coal, fuel-switching, new and more efficient plants, and the purchase of allowances, which encourages the reduction of emissions elsewhere. Promoting competition among these options increases the number of emissions reduction opportunities. Variations in adaptive capacity become a virtue rather than a problem as they would be under a command-and-control type of regulation. One estimate suggests that significant inter-utility trading beyond the year 2000 could produce savings of $3.5 billion annually compared to command and control.[8]

In a review of the emissions trading program created by the 1990 Clean Air Act Amendments, the U.S. General Accounting Office noted that the competition generated by the emissions program and the increasing deregulation of the electric power industry have worked to lower the cost of emissions reduction. Low-sulfur coal suppliers have expanded their markets to provide western coal as far east as Georgia, thus competing with eastern low-sulfur coal. Scrubber manufacturers have improved the quality of their product, increasing the sulfur dioxide removal capability and increasing durability, and have found ways to sell the by-products of the scrubbing process. All of these vendors are now competing against each other, an outcome not available with a command-and-control regulatory approach which limits the number of solutions that are acceptable and gives an advantage to the suppliers of those solutions. [9]

OTHER SUCCESSFUL TRADING PROGRAMS

While the sulfur dioxide emissions trading program is a high-profile success, other trading programs also have worked well on the local, regional, or national level. The town of Telluride, Colorado, for example, was severely affected by smoke pollution from fireplaces and wood-burning stoves. To solve this problem, in 1985 the town restricted the use of solid fuel burning devices and instituted an offset program of permit trading which required that the owners of a new solid fuel device purchase two permits from existing owners. The substitution of one for two devices automatically reduces the total number in existence, but still allows limited use of new wood-burning devices when demand exists.

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[8] *Ibid.*, p. 37.

[9] *Ibid.*, p. 29.

On the national level, the U.S. Environmental Protection Agency has used its own authority to create more limited emissions trading opportunities in response to the failure of purely command-and-control approaches. For example, in the 1970s the EPA adopted a policy of allowing the start-up of new emissions sources in areas not currently attaining current goals, provided that they used the best available technology (i.e., regulator-approved) and purchased emissions reduction credits from other sources, thereby offsetting the expected emissions increase. In other cases, USEPA allowed emissions at higher rates using emissions-control processes other than the regulator-approved technology if the emitting firm bought emissions reduction credits from other sources in the area. By the early 1980s, the Agency merged these policies into one rule which also permitted emissions reduction credits to be banked for use at a later date.

A more recent program to reduce smog in California's South Coast Air Quality Management District (SCAQMD) uses a system of tradable emissions. The region around Los Angeles has the poorest air quality in the United States and has had great difficulty in meeting the various dead-lines for improving air quality. The command-and-control regulation of air emissions was proving to be very expensive, as marginal costs of emissions reduction climbed to five times the national average in some categories.[10] The solution has been the use of an emissions trading program, starting with nitrogen and sulfur oxides from stationary sources.[11] The RECLAIM program (for Regional Clean Air Incentives Market), begun in 1994, gives operators of plants the choice of how to meet the emissions limitations imposed by SCAQMD.[12] More than 300 high-volume emissions sources (in excess of four tons annually) are covered by the program. In addition, many smaller sources have volunteered to join the RECLAIM program to take advantage of a flexibility in attaining compliance which is not available under command-and-control regulation.

The success of the RECLAIM program can be measured by a two-thirds reduction in total emissions, by a reduction in emissions beyond allocated levels, by a decrease in the market cost of emissions allowances below national averages, and by a reduction in job loss to 4 percent of levels anticipated under command and control.[13]

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[10] James M. Lents and Patricia Leyden, "RECLAIM: Los Angeles' New Market-Based Smog Cleanup Program," *Journal of Air and Waste Management*, 46 (March 1996), p. 197.

[11] Banking for later use is not permitted to avoid the possibility of future heavy concentrations of ozone.

[12] Volatile organic compounds (VOCs), along with nitrogen oxides, are the two major ingredients of smog. Because of their more diverse sources, VOCs have not yet been brought under the RECLAIM program.

[13] Patricia Leyden, Prepared Statement before the U.S. Senate Committee on Environment and Public Works, Subcommittee on Clean Air, Wetlands, Private Property and Nuclear Safety, Hearing on "Implementing the Proposed New Air Standards and the Use of Emissions Trading Programs," April 24, 1997.

CONCLUSION

Using tradable emissions to achieve regulatory goals can be expanded to cover additional pollutants. Two possibilities are particulate matter and ozone under the Clean Air Act and carbon dioxide and other greenhouse gases under the Framework Convention on Climate Change.

The EPA is scheduled to release more stringent National Ambient Air Quality Standards for ozone and particulate matter in July 1997. The potentially high cost of regulations could be reduced with tradable emissions. Stationary sources might be regulated under a trading system like the one implemented for sulfur dioxide, and mobile sources could be addressed under a system which allows trading between diesel fuel and gasoline manufacturers.

The worldwide carbon dioxide problem has led to the consideration of limiting emissions, but the complexity of the carbon problem exceeds that of sulfur dioxide. To solve the acid rain problem, a sovereign nation was able to impose regulations on its citizens in implementing a cap on emissions; as a worldwide problem, capping carbon dioxide emissions requires the agreement of many sovereign states. Sulfur dioxide emissions were regulated in a fairly homogeneous economic environment; carbon dioxide must be regulated across nations that have different levels of industrial development and varying amounts of emissions. Sulfur dioxide sources are limited and identifiable; carbon dioxide has a variety of sources as well as offsetting sources of mitigation. Despite these potential differences, if the greenhouse gas problem is perceived to be a sufficient threat and if an international agreement is formulated to limit emissions of carbon dioxide, some form of market trading should be included to reduce the overall cost of the regulatory effort.

At the Third Conference of the Framework Convention on Climate Change in December 1997, several nations will propose the international trading of emissions. The United States is proposing an "emissions budget" for industrialized countries in carbon dioxide and other greenhouse gases. Developing countries, on the other hand, would be urged to adopt emissions budgets on a volunteer basis. The potential costs of such an extensive initiative will almost dictate the adoption of techniques like tradable emissions, providing some flexibility in meeting reduction goals.

Despite an initially slow recognition of the value of markets in seeking the lowest cost of pollution reduction, tradable emissions will undoubtedly have a larger role in future regulatory programs to fight pollution. Although some critics express concerns that individual firms are

making decisions about their own level of emissions, recognition that the aggregate industry or regional level of emissions is controlled by the regulators has reduced barriers to the use of tradable emissions, thus minimizing regulatory costs, preserving jobs, and lowering both production and consumer costs.

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