SO_2 Emissions Trading: Does it Work?

Emissions trading has allowed reduction in emissions of a critical pollutant and has drawn attention to an important new policy option, but the success of the program cannot truly be evaluated until 2000—at least a decade after the passage of the CAAA.

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The 1990 Clean Air Act Amendments (CAAA) incorporated a much-discussed innovation in environmental policy—tradable permits for sulfur dioxide (SO_2) emissions. In the years since the adoption of the CAAA, SO_2 emissions have fallen rapidly. However, it is surprisingly difficult to determine how much of a causal relationship exists between the policy and the decline in emissions, as we found in a recent review of the trading process.[1] Since similar tradable permit systems have been proposed for reduction of other pollutants and for promotion of renewable energy sources, an analysis of the experience with SO_2 trading may have broad implications for many areas of public policy for the electric industry.

The 1990 Clean Air Act Amendments

By 1980, a consensus had developed that anthropogenic SO_2 emissions, most of them from electric power plants, were the principal cause of acid precipitation. Dozens of proposals for controls on sulfur emissions were introduced in Congress in the 1980s, but none were adopted—both because of the high cost of scrubbers, the conventional control technology, and because of political opposition.

Emissions trading was the idea that finally broke the legislative

logjam, and won the support of the Bush administration and the Congress. The CAAA, introduced in 1989 and passed in 1990, set a cap on emissions, granted allowances equal to the cap (distributed to firms roughly in proportion to their 1985 emissions), and authorized trading in allowances within and between firms. Any firm that emitted sulfur in excess of the allowances it held would be fined $2000 per ton, significantly more than the cost of controls, and would lose a one-ton emission allowance for the next year for each ton of excess emissions.

Of course the law, as finally passed, was considerably more complex than this simple description. The most significant source of complexity was the distinction between Phase I and Phase II of the implementation. Phase I began in 1995 and covered only the largest sulfur emitters (110 plants, comprising 263 units—primarily older, coal-burning plants), which were required to achieve a moderately reduced level of emissions. Phase II will begin in 2000 and will require all participants to achieve a much lower level of emissions. The result of this two-phase procedure was a modest drop in the cap on total nationwide emissions in 1995, to be followed by a much bigger drop in 2000, and then several smaller reductions as various loopholes and special provisions expire in later years. The final cap is about half of the late 1980s peak level of emissions.

Emissions trading, as embodied in the CAAA, can be evaluated from three different perspectives. First, was it a political success? Second, did it have the intended results? And third, has it won acceptance as an appropriate policy approach for this and other environmental problems?

Emissions trading was a political success, though there is obvious room for improvement.

Forceful advocacy of emissions trading, primarily by the Environmental Defense Fund (EDF) and academic economists, was crucial to the adoption of the CAAA. For congressional moderates in both parties, and for key Bush administration figures, EDF's approach was a more acceptable alternative to the conventional environmental regulation advocated by congressional liberals and EPA staff. Without the provision for tradable permits, it is unlikely that any measure reducing SO_2 emissions would have been adopted in 1990.

One aspect of emissions trading that proved controversial—and could be improved on in future systems—was the initial distribution of allowances.

Although the broad outlines and many of the details of the CAAA were important to its passage, a number of provisions could be improved. For example, while the trading mechanism is simpler to administer than traditional regulation of emissions, it still has posed greater-than-anticipated administrative burdens. CAAA enforcement requires continuous emissions monitoring at hundreds of facilities in Phase I, and thousands in Phase II. Formal registration of allowance ownership, which must be updated every time they change hands, is also required. An EPA internal review suggested that a $1 per ton emissions fee should have been included in the CAAA to support administration of the new regulatory process.

Another aspect of emissions trading that proved controversial—and could be improved in future trading systems—was the initial distribution of allowances. This obscure process in effect distributed the regulatory burden and created winners and losers. In the end, 29 different formulas were involved in the allocation of allowances. One could argue that allocation of allowances via debate in Congressional committees is more democratic and open to public view than the bureaucratic decision-making that often picks *de facto* winners and losers under traditional controls. Nonetheless, few people outside the industry realized the importance of the 29 allocation formulas until long after they were adopted. Alternative allocation procedures

could be envisioned, such as a government auction of all allowances—an approach that would vastly simplify the process while generating public revenue. (Under the CAAA, only a small number of allowances, less than three percent of the total, are auctioned annually by the EPA.) The benefits of allowance trading suggested by economic theory do not depend on the choice of one or another method of initial allocation.

A related point about the politics of emissions trading involves the precedent set by the CAAA. If allowances are distributed largely in proportion to base-year emissions, there is a danger of creating a perverse incentive to postpone pollution reduction efforts until after the base year. In fact, part (by no means all) of the complexity of the 29 allocation rules was caused by a desire to credit those who reduced sulfur emissions before the 1985 base year. Some utilities now working on early reductions of carbon emissions expect to qualify for similar credits if carbon trading is introduced. The lesson for the future: When proposing new trading systems, the base year should be set as early as possible, and some form of credit should be granted for early reductions.

SO_2 emissions have dropped, but the role of emissions trading is uncertain.

SO_2 emissions have fallen rapidly, even faster than required by Phase I of the CAAA. However, trading between firms has not yet reached a scale at which it could be credited with playing a large part in the emissions reduction. That is, purchases of allowances by one utility from another have played almost no role in Phase I compliance.

A much greater volume of trading has occurred internally, between units of the same company. This is undoubtedly where allowance trading has had the greatest impact. In effect, the CAAA sets up a company-wide "bubble" over each firm, and allows management complete freedom to reallocate pollution rights and reduction efforts within the bubble. Traditional regulation set standards separately for each individual emissions source; in contrast, the flexibility of the new approach has allowed faster, lower-cost reductions in aggregate emissions.

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When allowances have been traded between firms, the prices have been surprisingly low. Before the adoption of the CAAA, the cost of conventional controls was estimated at $1500 per ton of emissions. The EPA and other analysts initially predicted that trading would lower the cost of controls to $500-$750 per ton; optimists hoped that the cost would eventually fall to $250. In fact, trading began at $250, and the price has been at or below $150 per ton of emissions for several years. In May 1997, allowances traded at roughly $95.

Companies that decide not to buy allowances from others—the majority of companies, to date—must have found a way to reduce their own emissions, at a cost comparable to, or less than, the price of allowances. For many utilities in the 1990s, the key to that reduction has been cheap low-sulfur coal. In the past, Western low-sulfur coal had been prohibitively expensive for Midwestern utilities due to high transportation costs. By the time Wyoming coal reached the Mississippi, rail freight charges traditionally accounted for well over half of its delivered cost. Railroad deregulation in the 1980s changed the equation, expanding the region within which Western coal is competitive with Appalachian and Midwestern high-sulfur coal.

Traditional utility regulation may also have discouraged external allowance sales, although deregulation will reduce the importance of this effect in the future. Regulation generally requires that any operating savings be passed on to customers, and allows any prudently incurred costs to be passed on as well. Imprudent costs, however, may be disal-

lowed by regulators; that is, they may have to come out of profits. So if a utility sells allowances and later buys them back at a lower price, it will likely have to pass on the savings in the form of lower rates. But if it sells allowances and later buys them back at a higher price, it runs the risk of having the difference in price declared an imprudent cost. Naturally, this makes utilities reluctant to sell allowances if there is even a slight chance of needing them in the future.

Early participation in trading was also discouraged by arbitrary features of the CAAA, particularly the separation between Phase I and Phase II. In Phase I, the largest emitters must make moderate reductions; it is not until Phase II that all emitters must make substantial reductions. The two-phase structure means that only Phase I participants can sell excess allowances before 2000—and that the only likely customers are other Phase I participants, most of whom have ample low-cost opportunities for emission reductions on their own. As a result, both sales and prices have been low. A more rapid start-up, affecting all participants simultaneously, would likely have increased the use, and the benefits, of the trading mechanism.

Another CAAA provision, not necessarily undesirable, has also limited trading to date. Utilities with excess Phase I allowances can "bank" them for later use in meeting the stricter Phase II emission limits. This feature enables utilities to ease the transition into Phase II. Over-compliance with Phase I has led to banked allowances, in effect buying the right for some firms to take extra time beyond 2000 to come into compliance with the Phase II limits. The popularity of allowance banking, however, has reduced the sales of excess allowances.

Some of the institutional factors that have limited trading may seem undesirable, and efforts could be made to avoid them in the future. The decreased cost of low-sulfur coal, however, appears to be good news for SO_2 reduction; presumably this is not something to be avoided. Yet the impact of cheap coal introduces a puzzle into the analysis of emissions trading. Most observers attribute a majority of the SO_2 emission reductions in the 1990s to utilities switching to low-sulfur coal. To the extent that pollution is reduced by fuel-switching, which would have been profitable in any case, what is added by emissions trading? As long as cheap low-sulfur coal was beginning to travel eastward in the late 1980s, any policy adopted in 1990 might have looked similarly, and misleadingly, effective.

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Trading may well play a larger role in Phase II compliance, starting in 2000. The volume of allowance trading has been growing in 1997, with some independent power producers, distributors, and coal companies, among others, showing an interest in purchasing allowances for future use. However, the industry's over-compliance with Phase I has resulted in an ample supply of allowances to meet this demand; therefore, prices have remained low. And, it is impossible to predict how many of the Phase II participants (thousands of whom will be inexperienced with the program) will make use of the opportunity to trade.

Yet even if active trading between firms becomes central to Phase II compliance, this will occur a full decade after adoption of the CAAA—a remarkably slow start-up for a policy innovation. Allowance trading is, at the same time, already "old news" to many observers, and still three years away from the first real test of its full potential.

Overall evaluation of the CAAA emissions trading mechanism remains controversial.

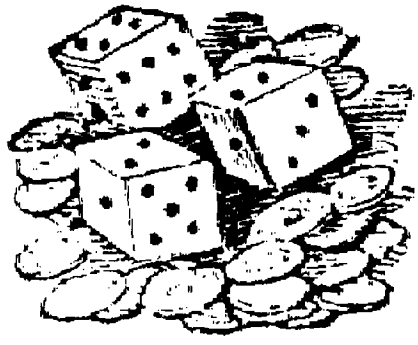
In political terms, the CAAA incorporated an innovative approach to environmental policy which led to passage of legislation that requires a sharp reduction in

SO_2 emissions. In economic terms, emission reduction was achieved at an unexpectedly low cost, but much of this was due to the drop in low-sulfur coal prices. The ultimate contribution of trading will not become clear until after 2000—more than a decade after passage of the CAAA. Does this represent a success or a failure?

Overall evaluations of the CAAA trading mechanism are divided. At one extreme there are vocal "CAAA enthusiasts," including state officials in agencies such as the Illinois Environmental Protection Agency, who hope to reproduce the success in emissions reduction by applying similar strategies to other emissions. Economists and brokers, for different professional reasons, are generally predisposed toward enthusiasm for trading.

In the middle are observers who welcome the low-cost, rapid reduction in SO_2 emissions, but credit the reduction achieved thus far to features almost incidental to the CAAA. On this view, the CAAA is hardly even a good test of the idea of emissions trading. For example, the slowness with which active inter-firm trading began under the CAAA is not inevitable. A previous application of tradable permits, for refineries removing lead from gasoline in the 1980s, prompted much more immediate activity, and was unmistakably effective almost at once.

On the more critical end of the spectrum are many in the environmental community who raise both general and specific objections to allowance trading. The general objection is that the distribution of allowances appears to create a government-sanctioned right to pollute. If the environment, like life itself, is inherently priceless as a matter of ethical principle, then trading in permits to destroy pieces of it borders on sacrilege. (The trading in refinery lead permits in the 1980s differed in this regard, since the allowable lead levels declined steadily and rapidly toward zero; thus no permanent right to pollute was involved.)



There is also the more specific concern that pollutants may exceed critical levels in sensitive areas. Under the CAAA, total emissions are capped but the geographical distribution of those emissions is not limited. Any one area, therefore, could experience an increase in acid precipitation, even while overall totals are constant or declining. The rapid reduction in sulfur emissions has apparently avoided the creation of local "hot spots" in this case, but it remains a potential issue for future trading schemes.

Conclusion

The inclusion of emissions trading in the CAAA has been successful in two key respects: It has led to the adoption of legislation that is reducing emissions of a critical pollutant, and it has drawn attention to the potential of an important policy option that may be relevant for other pollution problems as well. But due to a number of coincidences (mostly fortunate), it is difficult to establish whether the CAAA trading mechanism will ultimately succeed on the economic grounds on which it is often justified.

In this regard, it is worth considering the meaning of the unexpectedly low price of allowances. Economists could maintain (and some do) that this simply shows that pollution reduction has been achieved very cheaply through the market. Even though the price is bound to rise as Phase II approaches, allowances will likely remain cheaper than anyone expected in 1990. Some observers are clearly troubled by such low prices. This may represent an echo of the environmental objection to emissions trading: If society is determined to sell something as precious and sensitive as the right to pollute, the price should at least be high enough to draw attention to the purchase and act as a disincentive for pollution.

Another response to the remarkably low price of allowances is that it makes it possible to lower the cap still further. If pollution reduction is so cheap, perhaps soci-

ety should buy more of it. The CAAA cap of roughly half of peak 1980s emissions was the result of arbitrary political compromises, not scientific analysis of critical loadings on sensitive areas. If the drafters of the legislation had known how low the cost of reduction would be, they might well have pushed for a lower cap.

Looking toward the future, there is no basis for "one size fits all" advocacy of emissions trading across the board. A more promising direction would be an analysis of the conditions under which various policy options are most appropriate. When is emissions trading the right answer? What factors made it more immediately effective in the case of refinery lead reduction? When are other market-based incentives likely to be more effective than emissions trading? And when is traditional regulation still the best approach? It might be reassuring, for example, to maintain rigorous, burdensome, command and control regulation of high-level radioactive waste.

An overly narrow focus on the CAAA trading mechanism and U.S. political considerations has also inhibited agreement on a comprehensive international SO_2 reduction protocol. The Economic Commission for Europe, an agency that includes all of the nations of Eastern and Western Europe, the U.S. and Canada, has been working since 1979 to reduce the long range transport of air pollutants in Europe and North America. It has developed a series of agreements that limit the export of pollutants across national boundaries, with reductions based upon the concept of critical loading of sensitive environments. The U.S. has worked to weaken the SO_2 standard because it conflicts with the CAAA, and has refused to become a party to the agreement. Surprisingly little work has been done to reconcile the two approaches or even to determine the true on-the-ground difference between them. The introduction of tradable permits could facilitate emissions reductions in Europe, while the utilization of critical loading criteria to determine emission reduction targets provides a rational basis that is lacking in U.S. legislation. Combining the best features of the two approaches might help reduce air pollution cost-effectively on both continents.

The U.S. "cap and trade" approach to lowering SO_2 emissions has been a major policy innovation, but it is too early to tell how effective it will ultimately be in achieving its goals. The flexibility introduced by the trading option, within firms at least as much as between them, appears to be a valuable contribution, but hard quantitative evaluation of its results is not yet possible. To be more effective, future agreements for other pollutants should reduce the administrative complexities of the CAAA, set more objectively based reduction goals, and encourage a more rapid phase-in of the reduction process. Nonetheless, the low cost and accelerated reduction of SO_2 emissions to date, whatever its causes, is certainly a major accomplishment. ■

Before trading began it was quite unclear how the players would fare.

Endnotes:

1. Our review centered on interviews with more than a dozen key participants and observers of the CAAA emissions trading process, supplemented by examination of a number of major documents related to the advocacy and development of emissions trading.

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