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ABSTRACT

The patchwork of laws designed to control air pollution from U.S. power plants has been criticized from a variety of different perspectives. Business groups argue that the laws are too complex and burdensome to industry. Environmentalists maintain that power plant emissions need to be further reduced because of their negative health effects, to combat global warming and to eliminate haze in our national parks. Economists claim that large emission reductions could be achieved rather cheaply by focusing control efforts on the decades-old power plants in the Midwest, but Midwesterners and their political representatives are understandably resistant to having to shoulder the costs.

This paper describes an economic mechanism that has been used in Sweden since 1990 to control NOx emissions and indicates how, if it were modified and expanded to include other pollutants, could be made to work much like multi-pollutant cap-and-trade — but with more flexibility and efficiency. In this feebate system, each power plant would either pay a fee or collect a rebate for each ton of emissions above, or below, their assigned "breakeven point". With the per-ton fee/rebate rate set high enough to bring the needed emission reductions and breakeven points adjusted each year so that total rebates equaled total fees, the resulting system would work like a frictionless cap-and-trade: companies having high control costs would pay fees into the system, in effect paying companies with low control costs to do some of their controlling for them. At the same time, the system would bring control costs at Midwestern plants into line with those of other plants throughout the country and would also (through the assignment of breakeven points) provide a wide range of choices of how the additional control costs could be distributed.

(The views expressed in this paper are those of the author and do not necessarily reflect the views or policies of the U.S. Environmental Protection Agency.)

INTRODUCTION

Economists have long been aware of the theoretical difficulties of regulation. Not only are they inflexible and unable to take into account the specific circumstances of individual businesses and industries, but they are economically inefficient. Unlike market mechanisms, which can obtain goods or services at the lowest possible price, regulations often force high-cost control efforts at some plants while failing to require low-cost controls at others.

In recent years, as laws, regulations and court rulings have accumulated, complaints by industry have become common and the power of lobbies attempting to resist or reverse environmental

progress has grown. However, without an alternative to regulation that will allow environmental progress to be made without aggravating an already large burden on business, it is nearly impossible to accommodate the needs of one side except at the expense of the opposing side.

Although environmentalists and regulators are reluctant to admit it, the burden placed on individual businesses — especially small firms — by the ever-increasing complexity of regulations is a legitimate concern. "The average annual cost of regulation, paperwork, and tax compliance for firms with fewer than 500 employees is about $5,000 per employee. Firms with 20 to 49 employees spend, on average, 19 cents out of every revenue dollar on regulatory costs."[1] According to Thomas Hopkins, author of the book The Cost of Federal Regulations, the annualized cost of environmental regulation doubled between 1977 and 1988 and doubled again by 2000, rising from $47 billion to $98 billion to $199 billion.[2] While the exact numbers are heavily dependent on assumptions and may be open to criticism, nevertheless it is hard to dispute the fact that regulatory costs are growing rapidly. Whether these costs have already become excessively burdensome or not, they cannot continue to grow as this rate without becoming a serious problem sooner or later. Given the increasing ability of various lobbies and interest groups to successfully resist and even reverse environmental regulation in the name of deregulation, the time for finding new approaches may be now.

The nature of deregulation efforts has taken different forms in different regulatory contexts depending on the problems that prompted the regulation in the first place. Since regulation came about in industries such as transportation, telecommunications and electric utilities largely in response to monopolistic and oligopolistic behavior, the focus there has been on maintaining and encouraging competition. Environmental regulation, however, was not in response to market *imperfections* so much as absolute market *failure*: an unregulated market failed to reflect back to polluters the social costs of their actions. In the case of environmental regulation, therefore, it is much more difficult to find a third alternative in between burdensome regulation and reversal of environmental progress.

As a result of the difficulty of finding a third way between the extremes of environmental progress at the expense of rapidly growing regulation, on the one hand, and relaxation of environmental standards, on the other, the political struggle over environmental regulation increasingly tends to be a wasteful zero-sum game fought between the two sides. Environmentalists press for strengthening and broadening government regulations with little regard for the burden it places on business while the most polluting industries and their allies work to resist or reverse environmental regulation. But increasingly, as the two sides neutralize each other, both sides lose. Environmentalists, utilizing burdensome means to achieve laudable ends are increasingly frustrated and puzzled as environmental progress stalls and they find themselves losing public support. Industry, on the other hand, continues to be burdened by the growing burden of regulation and the substantial uncertainties of a regulatory climate shaped by political conflict. Both sides waste huge amounts of time and resources merely countering the lobbying efforts of their opponents.

One example of how a regulatory system that is shaped by a struggle among lobbyists and special interests can be inequitable and inefficient is illustrated by the controversy over

"grandfathered" power plants. Environmentalists, regulators and industries in the Northeast have long resented the ability of large, coal-fired power plants in the Southeast and Midwest to emit substantial quantities of particulate, sulfur dioxide and nitrogen oxide emissions, that are transported into Pennsylvania, New York and New England. Originally exempted from the pollution control standards imposed on new facilities in the 1970s by the Clean Air Act, many of these old coal plants produce up to10 times as much nitrogen oxides and sulfur dioxide as are permitted from new plants. [3] Although "New Source Review" (NSR) requirements were passed, forcing these plants to be treated as new sources when they expanded capacity or "significantly modified" their facilities, many of these plants have been able to avoid NSR requirements claiming that they are engaging in routine maintenance. Now that the power industry is being deregulated, the fear is that this inequity will be amplified still further as the market, seeking the lowest-cost source of power, decreases its reliance on cleaner plants and increases its reliance on the artificially cheaper, and highly polluting, plants. Although the Clinton Administration brought enforcement actions against seven power companies at 32 power plants in late 1999 [4], the Bush Administration recently halted those enforcement actions and has proposed relaxation of NSR requirements. [5]

Until recently there have been few alternatives that significantly reduce the burden and inefficiency of regulations while still being effective in reducing pollution. The purpose of this paper is to describe how a feebate system similar to that used in Sweden since 1990 could make use of pricing mechanisms, rather than regulation, to control power plant emissions. Implementation of such a mechanism could represent a significant step toward providing a "third way", one in which environmental progress and a reduction in the burden of regulation could go hand in hand.

Background

Economists have long criticized regulation as an inefficient means of allocating control. By setting pollution control requirements for individual companies without knowing the costs of control for those companies, regulators do not reduce emissions efficiently, i.e. at the lowest possible price. Since control for some companies is very expensive for each ton of reduction, while control for other companies is very cheap, it would be possible to reduce control costs significantly by replacing expensive emission reductions at one plant with cheap emission reductions at another.

In addition to being inefficient, however, regulations also have numerous other faults. First, they are inflexible — they do not change to fit changing circumstances and technology. Therefore, even if a given set of regulations is efficient and ideally suited to circumstances when it is implemented, it rapidly becomes obsolete. Equally important, regulations provide no incentive for polluters to reduce emissions below standards or to take actions other than meeting technical requirements. Since control of many pollutants — oxides of nitrogen (NOx) in particular — is highly dependent on fine tuning of the combustion system, regulations are often limited in their capabilities. Finally, the regulatory approach pits the legal system and the market system, government and business, against each other. Rather than changing market incentives so that it is no longer profitable to pollute, regulations leave existing incentives in place and make it illegal

to follow them. This, not only means both sides waste significant time and resources in conflict, but turns businessmen into criminals and government officials into autocratic bureaucrats.

In the 1920s, Pigou proposed a mechanism that would change market incentives so as to make it more profitable to control emissions than emit them into the environment: the emission tax. By imposing a tax (ideally equal to the marginal cost of the damage caused by the pollutant) for each ton of pollution emitted, the market itself would control pollution most efficiently and equitably. In effect by raising the tax to the proper level, companies would begin with the cheapest reductions and keep reducing until the cost of the last ton reduced was the same as the emission tax. This would reduce emissions at the cheapest possible cost (ignoring the cost of the tax) and result in all companies being controlled to the same marginal cost level (the cost per ton for the last ton of emissions). At that point, no improvement could be made by trading expensive reductions for cheap reductions because they would all have the same marginal cost. This would bring economic equity among the polluters as well as efficiency, since everyone would be paying the same amount for the last ton of emission reduction. It would also eliminate the need for regulation, since the social cost of pollution would now be "internalized" in the general cost of doing things. Not only would polluters eagerly control pollution to maximize profits, but consumers would avoid products that involved pollution because the social costs would be reflected in their prices.

But while an emission tax seemed great in theory, it had serious practical problems. The main problem was that polluters not only had to pay for the cost of control (ABCD in figure 1, right), they also had to pay the tax (EFBA in figure 1). This would not only lower profits and put some companies out of business, but it would undoubtedly result in higher prices. Furthermore, the tax imposed on polluters would be highest during those first few years when firms were investing in control equipment. On the other hand, when some advocates tried to overcome this problem by offering fee proposals with substantially lower rates, this only undermined the already weak credibility of the emission fee among environmentalists. They began referring to it (with increasingly good reason) as a measure that allowed polluters to "pay to pollute." Taken together, these problems caused environmentalists, businessmen and policy-makers to all dismiss the emission fee as an unrealistic experiment.

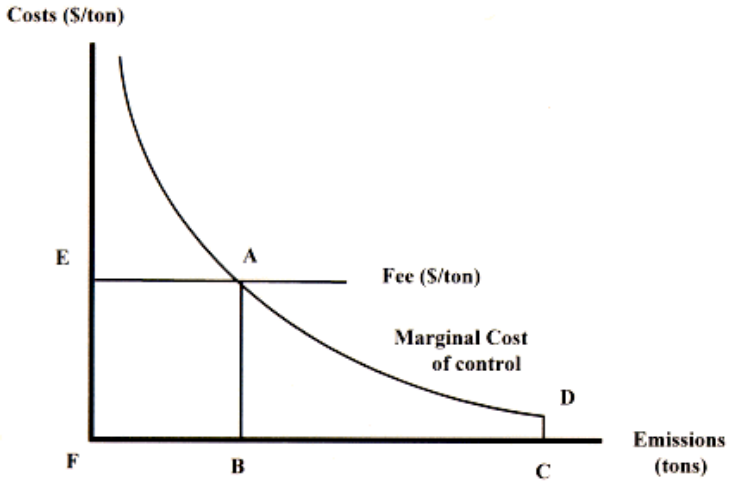

Figure 1: Emission Fee or Feebate

Without the emission fee as a viable practical alternative, attention soon shifted from price-based to quantity-based

mechanisms. In 1960 Coase proposed an alternative approach to the emission fee that would make use of property rights to control pollution. [7] Instead of the government setting the price of emissions directly through an emission tax, it would establish a limited quantity of transferable emission rights and then allow the market — businesses bidding for these scarce pollution rights — to set prices. The principle advantage as compared to an emission fee would be that control could be achieved through the market without having to impose the additional burden of the tax (EFBA in figure 1). The idea was that those companies with low marginal control costs would be able to profit by reducing emissions and selling the pollution rights to companies with high marginal control costs.

By the 1970s, the idea of grafting marketable permits onto existing regulation was being given serious consideration In 1976 it became the basis for a new "offset" policy that allowed potentially new sources to enter "nonattainment areas" (areas not meeting the air quality standards of the Clean Air Act) provided they obtained "offsets" amounting to 120% of the new emissions. A few years later, marketable permits were incorporated into a bill to reduce power plant emissions contributing to acid rain. After initially allocating emission allowances to existing plants, the quantity of allowances was to be reduced in two phases starting in 1995 and 2000. This would force companies to either reduce their emissions or purchase allowances from other plants.

Theoretically, it is possible to allocate marketable permits (including offsets and allowances) in a number of ways, including auction or lottery. Politically, however, it is difficult to distribute them in any other way except based on historical emissions (the practice now known as "grandfathering"). Economic studies have found that other allocation methods were inferior because any efficiency advantages were outweighed by the financial burden placed on companies in having to purchase permits. [9]

But "grandfathering" creates problems for marketable permits, in general, and tradable permits, in particular. First of all, transaction costs are high. It is difficult for companies to meet the conditions that make allowances transferable and arranging sales can be very complex. Furthermore, companies are reluctant to give up allowances. Even though mechanisms have been created to allow emission permits to be traded on the Chicago Board of Trade, nevertheless, trading has been limited. For the most part, in fact, firms have preferred to transfer allowances within their companies rather than arrange external sales. [10]

This means that, in practice, marketable permits share many of the problems associated with regulations. Just as companies have little or no incentive to reduce emissions below the requirements of regulations, so they have little incentive to control once their emissions meet the emission limits of permits or caps. As a result, allowance trading has done little to prevent the concentration of pollution at the dirtiest plants. The same low-cost opportunities for control that went to waste under pure regulation continue to be wasted in spite of allowance trading. While, in theory, the market price for permits should have been high enough to encourage these plants to reduce emissions in order to sell them at a profit, the reality has been that transaction costs are too high to make this work. In addition, there is now a bias against new sources which not only have to meet the latest standards, but also have to purchase allowances to cover whatever

emissions cannot be controlled.

With regard to flexibility, marketable permits or emission caps clearly provide more flexibility for companies seeking to enter nonattainment areas than they would otherwise have. But once companies have obtained their allowances and have reached compliance, there is not much difference. As conditions change and technology advances, there is little incentive for companies in compliance — or meeting emission caps — to reduce emissions. Furthermore, provisions for offsets and emission allowances do not significantly reduce the burden and complexity of the regulatory environment. In many respects, in fact, they make matters worse. Now, in addition to regulatory requirements, companies have to keep track of emission caps, track trades and concern themselves with the legal difficulties of negotiating trades..

The Feebate as a Revenue-Neutral Emission Fee

During the last two decades, while attention among most regulators in the United States was focused on quantity-based approaches, some in this country and in Europe were searching for ways to overcome the practical problems with the emission fee — especially the problem of transferring revenue from industry to government. What has emerged is a whole class of mechanisms often referred to as Budget Neutral Instruments, which allow the government to *influence* economic mechanisms without imposing any significant financial burden on industry. Included among such instruments is the feebate, a mechanism that simultaneously charges fees and rebates the revenue collected, but does this in such a way as to create social incentives and disincentives.

Of particular interest are attempts to structure feebate systems as *revenue-neutral emission fees* (RNEF's). By simultaneously charging a fee per ton of emissions and rebating the revenue in some way that does not undermine the incentive effects of the emission fee, RNEF's can achieve the advantages of a simple emission fee without many of its limitations. This means that it can compare favorably with marketable permits as a *practical* mechanism. Like tradable permits, it does not impose on companies the burden of a tax on top of the cost of control. But unlike tradable permits a RNEF can:

1) provide a strong incentive for *all* companies to reduce emissions, regardless of whether their emissions are above or below allowed levels;
2) allow companies to adjust to circumstances and changing technology;
3) potentially reduce the complexity and burden of regulation;
4) begin to correct market incentives so that profit-maximization does not cause polluters to avoid government regulations but rather to control beyond what is required.

One early *revenue-neutral emission fee* (RNEF) proposal emerged in the early 1980s as a proposal to control sulfur dioxide emissions in the Philadelphia region. [11] This RNEF proposal would have set "breakeven points" for all sources based on historical emissions. Each source would then either pay a fee for each ton of emissions above its breakeven point or collect a rebate for each ton of emissions below its breakeven point. Since the fee rate and rebate rates were the same per ton (the common rate was called an "incentive rate"), the mechanism would

have had the same effect as an emission fee charging the same rate per ton. Sources would not simply control to reach their breakeven point but would control until their marginal cost of control was equal to the incentive rate. Sources above their breakeven level of emissions would do so to reduce their fees while sources below would do so to maximize their rebate. In effect the system would bring control at the lowest cost by automatically arranging emission "trades" between companies with high marginal control costs (who would pay fees into the system) and companies with low marginal control costs (who would get paid to do their controlling for them). The system would have operated like a marketable permit system — but without any significant transaction costs.

In 1992 a RNEF was implemented in Sweden for control of NOx emissions. This system, which initially applied to all plants having a capacity of 10 MW (35 Btu/h) and an annual energy production of more than 50 GWh (170,000 Btu), both imposes a charge of roughly $5000 (40,000 Swedish Kroner) per ton of nitrogen oxide (NOx) emitted (measured as NO_2) and rebates the collected revenue in proportion to energy produced. [12] This creates a strong incentive both to reduce emissions and improve energy efficiency. Those sources that have high emission-to-energy-production ratios end up paying more than they receive in rebates while those with low ratios receive a net rebate.

Administratively, the system is relatively simple. At the end of the year, companies submit documentation of their emissions during the previous year (sources in the system are required to have continuous emission monitoring) as well as their energy production. The Swedish Environmental Protection Agency (SEPA) multiplies total emissions by the fee rate to determine total revenues; deducts 0.25 percent to cover administration; determines the rebate rate and the rebates due for individual sources; and then notifies sources of their net fee or rebate.

The system has been successful in several respects. It has not reduced the competitiveness of Sweden's energy industry or imposed a burden on Sweden's economy (concerns that prompted rejection of an emission charge). Industry has responded favorably to the system (they like the idea that it creates accountability for results). Most importantly, it has reduced NOx emissions more rapidly than expected, with a 35% reduction by 1992 (expected by 1995) and a 44% reduction by 1993. [13]

There is strong evidence to suggest that incentives are working to encourage reductions that would not have taken place under existing regulations. A study by SEPA estimated that emission reductions would have been 5,960 tons per year with existing quantitative limits but that the RNEF resulted in a total reduction of 18,570 tons (roughly 4,000 tons of which were due to fine-tuning combustion processes to minimize NOx emissions). [14] New sources entering the system in 1996 and 1997 (when the system was expanded to include smaller sources) showed the same drop in emission rates in response to the charge as original plants entering the system in 1992. [15] That companies are themselves finding new ways to reduce emissions that could not have been forced through regulations or emission caps is suggested, not only by the reductions due to fine-tuning adjustments, but also by the fact that some companies have established bonus systems for operators in which the salary bonus increases as emissions decline. [16]

The Feebate Proposal for Power Plants

Few would dispute that the laws and regulations currently governing air pollution emissions from power plants in the U.S. are open to improvement. Environmentalists argue that emissions need to be significantly reduced for a variety or reasons. Industry complains bitterly about the complexity of the laws, the cost of compliance and the uncertainty of the future. Inequities in control costs between older, coal-fired plants originally exempted from Clean Air Act requirements and new plants forced to invest in the latest, most expensive control technology are both a source of controversy and an opportunity for relatively inexpensive reductions in emissions. Yet little agreement has been achieved in addressing these issues because use of prevailing regulatory tools only offers to resolve one set of issues at the expense of aggravating other issues.

In July of 2001, EPA had reportedly developed a legislative proposal to implement a cap-and-trade program for power plant emissions that would reduce sulfur dioxide and mercury emissions by 80 percent and nitrogen oxide emissions by 75 percent. Industry immediately rejected the proposal, saying that the costs of such a drastic reduction would be incalculable, causing economic disaster, a threat to the nations' supply of electricity and increased prices. More recently, the Bush administration has been considering a recommendation to relax new source review requirements. Environmental groups, Democratic leaders in Congress, and attorneys general from various Northeastern states say this would be an environmental disaster and threatened to sue.

Could some variation of a *revenue-neutral emission fee* provide a middle ground between saddling the power industry with unknown costs and environmental relaxation? There is little doubt it could achieve whatever reduction in emissions is desired at a lower, more predictable cost than would be possible under a cap-and-trade program. Costs would be lower due to the ability of incentives to extract low-cost reductions from all companies, not just those above their emission caps. Costs would be more predictable because the fee rate, not the quantity of emissions, would be set. Although price-based instruments such as RNEFs have been resisted in the past because the critical goal has been to achieve a precise emission target — even if the cost imposed on industry was unknown — under present circumstances it may be more desirable to control the cost of control and be willing to accept some imprecision about the environmental result (judging by Sweden's experience, advance estimates of emission reductions are likely to understate actual reductions). A RNEF could also offer industry an opportunity to move away from the burden of regulation to the flexibility and efficiency of the market.

A key question is how to rebate the revenue collected from the fee. One possibility would be to implement some variation of the Swedish system, with fee revenue rebated in proportion to energy produced. This system would both curb emissions and encourage energy production. But, given the large net payments that older, "grandfathered" plants would undoubtedly have to pay under such a system, it is doubtful that such a system would gain political acceptance. The same interests that allowed these sources to be exempted from Clean Air Act requirements in the first place would undoubtedly defeat this system as well.

Another possibility would be to structure a RNEF to operate similar to a cap-and-trade. Such a system would be similar to the Philadelphia proposal, with sources being assigned breakeven points which would initially be proportional to historical emissions (if the target reduction is 40 percent, they would be 60 percent of historical emissions). The fee rate would be set high enough, based on studies of marginal control costs, to bring the targeted reduction in emissions. Once the system had been in effect for seven years, the breakeven points would be based on a formula related to emissions between 5 and 7 years prior to the current year. This would allow companies with opportunities for low-cost control to collect net payments based on reduced emissions for a 5 to 7 year period, but once the cost of the investment had been paid off, the breakeven point would rise to match current emissions and no further net payment would be available through the system unless additional reductions were made. The resulting RNEF would have an impact similar to a cap-and-trade program, but with several critical differences:

1) The RNEF would bring an equitable distribution of control burden between older, "grandfathered" companies and new companies without imposing a politically unacceptable burden on older companies. Older companies with low control costs would reduce emissions — receiving a rebate through the system from companies with higher control costs. These companies, however, would only receive a net rebate for their emission reduction for seven years.
2) The initial distribution of the financial cost could be adjusted independent of control levels by adjusting breakeven points (since it is the fee rate that determines control levels). Thus if Northeastern states balked at allowing "grandfathered" plants to be subsidized in controlling to the same level as newer plants, breakeven points could be set to result in no subsidization (i.e. with breakeven point emissions based on BACT) or partial subsidization.
3) Companies with the lowest cost opportunities for control would control even if emissions were below levels set by regulations, allowances or offsets — or breakeven points.
4) Companies would make adjustments to changes in technology.
5) Emission reductions would not be precisely determined, but costs would be predictable.
6) Transaction costs would essentially be zero. Companies would not have to arrange trades, but trades would be accomplished automatically through the feebate system.
7) Businessmen and government regulators would work hand in hand to reduce pollution.

CONCLUSIONS

A *revenue-neutral emission fee* (RNEF) would provide a practical mechanism for controlling emissions from power plants and has the potential to provide a middle ground that allows environmental goals to be achieved while minimizing the burden and complexity of regulations.

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