COMPARING ECONOMIC AND ADMINISTRATIVE INSTRUMENTS: THE U.S. EXPERIENCE

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Environmental Discussion Paper No. 6
January 1995

C4EP PROJECT
Central and Eastern Europe Environmental Economics and Policy Project

This paper was sponsored by the Harvard Institute for International Development (HIID) under a cooperative agreement with the U.S. Agency for Intenational Development (USAID. It was prepared for a workshop on Economic Instruments for Sustainable Development organized by the Ministry of the Environment of the Czech Republic.

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Acknowledgments: Appreciation is extended to the Ministry of Environment of the Czech Republic and to the U.S. Agency for International Development for support and encouragement while this was being written in the Czech Republic. Particular thanks are due to: Robert Hahn, Gordon Hester, Jaromir Kovar, Robin Langdon, Josh Margolis, Bedrich Moldan, Jan Pisko, Stephen Pritchard, Josef Sejak, Zdenek Stepanek and Jeff Vincent.

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The U.S. Experience

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I. Introduction

The United States experience demonstrates ways in which economic instruments have been combined with administrative methods to achieve environmental and development goals. Environmental and development goals that require financing and investment are not unique to economies in transition or developing countries. In the U.S. there is a strong appeal to the vision of environmental programs that:

- are consistent with market principles,
- improve environmental quality,
- save industry money, and
- save jobs

But no country can consider economic instruments with a clean slate from history. With a historical slate of environmental programs already written, economic instruments may make positive improvements in each of the above areas but such improvements should not be overstated. Economic instruments can also have no or unintended effects if they conflict with a stronger standard. However, it has been said that administrative methods saved the United States from drowning in environmental disaster. If economic instruments had been adapted earlier or more widespread it may have been possible to save a little bit more of the environment and to save a little bit more of the economy as well.

This case study of the United States experience contains four parts. The remainder of this section discusses the size and extent of the U.S. experience with market instruments. Section II describes a basis for comparing economic and administrative methods. Section III looks closely at the United States experience in emissions trading and charges along the dimensions defined in Section II. Section IV summarizes the key lessons, both good and bad. An appendix provides a summary of how the trading program in Los Angeles is designed to meet or exceed administrative requirements, a summary of studies on the maximum cost savings estimated for economic instruments

and several short descriptions of emissions trading activity carried out by a for profit company in the United States.

In the United States, the vast majority of environmental policies are administrative methods. Economic instruments have almost always been tightly constrained to fit within the existing administrative structure. Even so, as of 1992, the OECD identified the United States as having the numerically largest number of economic instruments approaches although it is difficult to count the number of programs and their importance (see Barde; Barthold; Farrow (1991)).

Table 1: Economic Instruments in OECD Countries on 1-1-92 (Barde, 1994)

OECD Country	Charges on Emissions	Charges on Products	Deposit/ Refund	Tradeable Permits	Enforcement Incentive	Total
USA	5	6	4	8	2	25
Sweden	3	11	4		2	20
Canada	3	7	1	2	2	15
Denmark	3	10	2			15
Finland	3	10	2			15
Norway	4	8	3			15
Australia	5	1	3	1	2	12
Netherlands	5	4	2			11
Austria	3	4	3			10
Germany	5	3	2	1		11
Belgium	7	2	1			10
France	5	2				7
Switzerland	3	2	1			6
Italy	3	2				5
Iceland	1	1	2			4
Japan	3	1				4
Portugal	2	1	1			4
Ireland	2	1				3
Greece		2	1			3
Spain	3					3
UK	1	1				2
New Zealand	1					1
Turkey			1			1
Instrument Total	**70**	**79**	**33**	**12**	**8**	**202**

The United States has estimated that all its environmental regulations, administrative and economic, cost approximately 2.5 percent of GNP, a total of about 127 billion (10^9) (1986) dollars[1]. Air quality regulations, the application of most U.S. economic instruments, account for approximately 30 percent of the cost of environmental regulations From the chart below, one can see the significant increase in cost from new regulations, a significant part of which is from the Clean Air Act of 1990 which has a large trading provision.

Source: U.S. EPA (1990)

[1] Costs are calculated as annualized expenditures and so do not include more complex measures of economic costs or benefits (U.S. EPA, 1990.)

In the period from 1974 to 1985, when expenditures on air pollution are estimated to have totaled almost $150 billion, other estimates to be discussed below suggest that at most $13 billion may have been saved from the limited use of economic instruments. The size of the saving may increase substantially as the sulfur dioxide trading provisions of the Clean Air Act start to have a larger effect.

If true, are these savings large or small? In relation to the total amount spent on environmental regulation, they are relatively small. But in importance to individual companies it is clear that the possible saving of 13 billion dollars is some real help in the competitive marketplace. Cost savings of this amount imply that the environment was improved to the same extent as with administrative procedures but that the productive potential of almost 500,000 worker-years could be shifted into more competitive tasks.

II. Basis of Comparing Economic and Administrative Methods

A. Environmental quality
B. Economics
    1. Cost effectiveness
    2. Technological change
    3. Benefit-cost
C. Interests of participants
D. Interaction between instruments

This section reviews several criteria for comparing economic with administrative instruments. In general, the changes that are described are in comparison to the use of administrative instruments. The first issue is the environment. Any organization whose mission is to preserve the environment must focus on environmental outcomes--is the environment better or worse off after the application of economic instruments? The answer is usually embedded in the design of economic instruments. In the case of Los Angeles, California, the state legislator made it a legal requirement that the air quality in

the district could not become worse as a result of using a trading approach[2] . In another case the political debates leading up the 1990 Clean Air Act make it clear that the large reduction in sulfur emissions, approximately 50 percent, were only possible because the cost saving structure of tradable permits was applied. In other words, environmentalists were able to increase their demands for environmental quality because of the cost savings conditions. The environment was improved relative to a command and control approach in the initial design of the policy. In other cases of trading an environmental improvement is required before the trade can be approved. This is done by allowing less than 1 tradable credit for each unit of pollution that is reduced. In general however, the environment in a given location or region will be better or the same only if that factor is designed into the application.

The most frequently cited basis for comparing administrative and economic instruments is the cost by industry to control to the same level of emissions as with administrative methods. This is a question of whether economic instruments are more cost effective than administrative methods. Numerous studies have been cited (Tietenberg; U.S. EPA; Appendix) to show that economic instruments which theoretically provide the signals necessary for a least cost solution have the potential to be less costly than administrative methods. Whether that potential is achieved in practice has only been studied a little. Some attention has also been given to whether over control at some locations, as occurs with standards, reduces the cost savings assumed for economic instruments. New attention is also being paid to the interactions of instruments, the size of transactions costs (cost of getting buyer and seller together), and the importance of clear property rights in the actual estimation of cost savings to industry.

A topic that remains clear in theory but not yet investigated in practice is the different incentive for technological change provided by economic and administrative

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[2] See South Coast Air Quality Management District, also the excerpt in the Appendix.

methods. Economic methods, which provide an incentive to reduce costs, are clearly preferable in theory. However, the modest applications of economic instruments in the context of strict standards has probably provided less incentive to develop new technologies than would a pure economic system. This issue is important because studies of technological change indicate that the majority of wealth that has been created over the last century has come from technological change. Environmental policies should not ignore such a strong force in the economy. My personal and anecdotal views are as follow.

The successful stories of pollution prevention speak of re-engineering processes in a way to save money. In the United States this most often occurs when administrative regulations have indirectly raised prices to industry. This has happened with hazardous materials where the cost of disposing of hazardous materials is now several times that of regular materials. Indirect costs such as liability exposure and the transactions costs of being involved in more restrictive levels of regulation also play a role in the economics of such changes. I view pollution prevention as the process of technological diffusion of ideas in response to a change in economic incentives. Whether this indirect response is faster or slower than the case with a more transparent economic instrument is not yet known. My unsupported view on dynamic cost effectiveness is that such changes might have proceeded more rapidly with clear economic signals earlier in the process.

What role does benefit-cost analysis have in the comparison of economic and administrative methods? As standardly developed, the comparison between the two methods is the least cost of achieving a given environmental objective. Both kinds of instruments can be mis-applied in the sense that the objective may over or under control such that the additional (marginal) costs exceed the benefits. There is a growing but still not majority feeling in the United States that new environmental regulations tend to have additional costs that exceed benefits (for example, Portney; Lyon and Farrow.) Economic instruments as discussed here do not address the issue of over or under control. Benefit-

cost analysis is sometimes suggested as a required input to the legal and regulatory process although the level of control in the U.S. remains a political decision. In the U.S. some regulations are subject to such analysis by Executive Order.

The preferences of different interest groups are describable but analytical analysis is in its early stages (Congleton, 1995.) One naturally expects environmental groups to be most concerned about quantities of pollution, a focus that leads to a preference for administrative methods or marketable permits. This preference has also been justified in theory if the damage function from emissions is quite steep relative to the control costs. There are of course, many different types of administrative methods which compare more or less favorably with economic instruments. For instance, performance standards are viewed by economists as being preferable to specifying technologies because performance standards allow some degree of flexibility to industry. Industry is also expected to be most concerned about costs. In the economic framework this might lead one to expect a preference for pollution taxes. However, pollution taxes as typically administered result in industry incurring costs both for reducing pollution and paying an additional amount for those emissions they do not control. In contrast, marketable permits, when given (grandfathered) to the polluting industries, can convey a valuable property right that increases the asset position of the firm. Although tax credits can be structured in a way that is parallel to grandfathered permits (Farrow, 1995) the U.S. experience is that tradable permits are more acceptable to industry <u>if</u> they must face a given level of regulation. It is fully expected that all interest groups use their political power to affect the level of control that is required.

Finally, bureaucracies themselves have preferences. Agencies become staffed with personnel who have particular training and interests and who in turn develop connections among the affected interest groups. An agency dominated by economists is going to be fundamentally different than an agency dominated by natural scientists. Each would be expected to favor regulations that control the measures they best understand.

As the U.S. EPA is dominated by natural scientists, they are likely to prefer the physical based measures as the basis of regulation.

The last basis of comparison is not a comparison of one method against another. It is the recognition that in practice in the United States, an economic approach has been attached to an existing administrative approach. Consider the problem as a mathematical optimization problem with two constraints, one administrative controls and one economic controls. The problem will be determined by the constraint that is most binding. In most cases in the U.S., the administrative constraint has been more binding so that economic approaches may have been redundant or had little effect. These programmatic interactions must be evaluated on a case by case basis.

III. Specific Programs

A. Instruments applied to ongoing requirements
    1. Air emission trading, limited and full markets
    2. Water discharges
B. Instruments applied to phasing out materials
    1. Toxic input trading for phase down (lead credits)
    2. CFC tax

Air Emissions

There has been an evolution in the flexibility given enterprises in the years since 1974 when the first type of air emission trading was allowed within the confines of emissions standards. While there are several different names for trading activities allowed in the context of emissions standards, they can be generalized as allowing intra (within one) firm trading, inter (among two) firm trading and banking (trading across time.) The most complete analysis of the actual impact of this flexibility was conducted by Hahn and Hester (1986.) The ongoing impact of this flexibility has not been evaluated since although individual articles are available on the first years of experience in the new

market created for sulfur dioxide emissions as a result of the 1990 Clean Air Act Amendments. The new market in sulfur dioxide emissions represents a complete market allowing inter-firm trading (among organizations of any type) and banking.

To make the discussion more concrete, an example of an inter-firm trade is briefly discussed below (an intra-firm trade is discussed later in the discussion on water.)

Example: Inter-firm trading and auction (RECLAIM)

> As part of the Southern California RECLAIM (Regional Clean Air Incentives Market) program, two companies, Union Carbide Corporation (seller) and Anchor Glass Container Corporation (buyer) reached an agreement to trade 1,700 tons of NOx reductions for a price of $1.2 million. The actual trade involved reductions by Union Carbide in 1994 and continuing every year. The cost savings to one party and the profit to the other party is not public knowledge.
>
> Market trading for this particular program (RECLAIM) is also facilitated by organized auctions by private consultants that bring together several companies at the same time. For instance, in July of 1994, 23 companies participated in an auction with 124,000 tons of NOx and SOx traded with an approximate trading value of over $40 million dollars. Again, the cost savings and the profit to the participants are not known.

As discussed in the introduction, the design of trading activities determines whether the environment will <u>actually</u> be the same, better, or worse than with administrative methods. In the initial stages of trading programs, there was concern for "paper" trades that did not correspond to real reductions on the part on the seller. An example of this might be if an old boiler, a source of particulate, SO2 and NOx emissions, has been shut down for a long period so that it is not in the base line of expected emissions but its "reductions" are traded for increases elsewhere. Improved monitoring and enforcement policies have reduced this problem. In some programs a

buyer must purchase a multiple (larger than 1) of emissions reduced by the seller. From the economic point of view this can viewed as requiring an improvement in the environment as a condition to trading. Others have justified a multiple on the basis of the uncertain measurement of the reductions. Finally, trading in the United States takes place in the context of ambient concentration limits. In general, trading is not allowed that would lead to violations of the ambient air quality standards. As a consequent of these conditions (and the fact that the majority of compliance is through meeting standards), it is considered that air quality has not been significantly affected for better or worse as a result of the application of economic instruments in air quality regulation.

Cost effectiveness

Cost effectiveness at a point in time is the most frequent comparison between administrative and economic air pollution instruments. There are two types of data available. The most frequent type of study compares estimated compliance costs using standards for a region, sometimes as small as a city and other times as large as the entire country, with the theoretical minimum cost achievable when the marginal (additional) cost of control per unit of pollutant is equated across sources. These studies typically show large potential savings from the use of economic instruments (for example, Appendix; Tietenberg).

The accuracy of these estimates of the maximum cost savings depends on the detail with which the researcher models the standards and the costs of pollution control technology. The actual cost savings are typically thought to be much less because there is generally less use of economic instruments in practice than there is expected. Some reasons given for this reduced use are:

- weak definition of property rights
- the cost of finding trading partners (transactions costs)
- too few possible trades in an area
- interaction with standards such as limited terms to the length of a trade or limitations placed upon trading by regional regulatory authorities such a public utility commissions.

An idea of the adjustment to the theoretical maximum cost savings can be obtained from simulation models where people experienced in the industry carry out trades. Even in this somewhat simplified world, Figure 1 illustrates that the theoretical maximum is not going to be achieved. In the example, based on SO2 trading simulations carried out by Decision Focus, the average savings for utilities were 17.8 percent compared with the 25 percent theoretical savings.

Source: Electric Power Research Institute, SO2 Trading Simulator

Limited data is available on the actual cost savings in individual trades. In order for transactions to take place, such as the $1.2 million dollar trade mentioned in the example, the gross cost savings must be sufficient to pay for the money part of the trade and also the internal transactions costs of the company. Hahn and Hester (1986) reviewed a variety of data to estimate the actual cost savings from several types of flexibility in compliance that comprised the air trading system at that time. They depended heavily on several U.S. EPA documents to estimate a range of costs savings for different programs. Depending on the program, the cost savings per trade in 1985 dollars ranged from about $100,000 to over $3 million. The lowest estimates of cost savings per trade came from the most frequently used program. That program (netting) allowed companies to search within one plant to find alternative methods of achieving their compliance requirement. The higher cost savings are associated with more complex programs that required multiple layers of EPA and public approval. Hahn and Hester's estimates of cost savings for the various programs as of the mid-1980's are reproduced below in Table 2.

The data in the table are arranged according to specific U.S. air programs. Columns 2 and 3 indicate the number of internal and external trades through the early 80's. Column 4 shows the cost savings in millions of dollars. These data, based on cost savings from case studies, have been used to suggest estimates of cost savings from economic instruments in the air pollution program from a few to 13 billion dollars in a time when total air pollution control expenditures for stationary sources in the United States equaled approximately $150 billion (in 1986 dollars.) Thus the maximum contribution through the mid-80's has been estimated to be about eight percent (on average, but growing over time) of the cost of implementing standards without the flexibility permitted with trading. As all countries face limitations on the amount of investment capital available, even such modest savings may help companies invest in other productive purposes. Finally, column 5 shows the authors assessment of the impact of economic instruments on environmental quality relative to administrative instruments. Thus the comment "insignificant" indicates that the two instruments probably achieved the same level of environmental improvement.

The absence of integrated assessments using case study data since the mid-1980's hinders estimates of ongoing cost savings. On one hand, the use of flexible approaches has become more widely known, on the other hand, once firms have reached attainment with the help of economic instruments they may not need to use them again until they wish to expand their facilities or move locations. A substantial time period has passed since 1985 compared to the period 1974 to 1985 for which the estimates were prepared. It is likely that substantial additional savings have been realized.

Two completely new program have also have been implemented in the United States since the estimates cited above. They are the national SO2 trading program and the regional (Southern California) trading programs. In each case there is only a few years experience with the program. To date, trading appears to be utilized less than expected although this is consistent with the above discussion that the largest cost savings came

from allowing companies to conduct intra-plant trades. It is likely that new programs will first encourage this inward look for cost savings.

The RECLAIM program in Southern California allows widespread trading in SOx and NOx. Forecasts of the potential cost savings from the program are approximately $58 million per year or about 40 percent of the cost using strict standards without the flexibility provided by trading (South Coast Air Quality Management District, 1993.) Some trading has already taken place under this new program (see example above) although there is debate about the speed with which trading is being used (Johnston, 1994; Margolis, 1994.)

It was also estimated that over 2,000 jobs would be lost using an administrative approach while 800 jobs would be lost when trading is allowed in the Southern California area (South Coast Air Quality Management District, 1993.) The 1,200 jobs potentially saved by economic instruments may be even more important politically than the cost savings to industry.

Cost savings were also an important in justifying the SO2 trading provisions of the 1990 Clean Air Act Amendment. This Amendment had many parts including new permitting requirements and hazardous air pollutants. The total increase in expenditures to comply with the Amendments when fully implemented may be approximately $25 billion dollars per year. The SO2 provisions were estimated to have cost about $4 billion if fully implemented in the usual manner but which might be implemented for approximately $3 billion when the flexibility of using fully tradable emission allowances is considered. Trading of allowances to comply with the first phase of 1995 compliance deadlines have been occurring for about two years (Hahn and May.)

Elsewhere in the conference Mr. Sanders mentions the fact that the SO2 program, for which compliance actually just began in 1995, has seen 523 trades leading up to the start of the program. About 1 million allowances have traded hands to date for an approximate value of $250 million dollars. Some cost savings have clearly taken place,

just how much is not yet known. Initial trading has taken place at prices and quantities less than predicted in simulation studies. It is not yet clear what implications this has for the cost effectiveness of trading. It is likely that companies are first looking for internal trades, particularly as almost all utilities operate multiple generating plants. It is also likely, that as the European economies in transition are finding, it takes some time for previously regulated entities to fully learn how to use a new market. Finally, the many the implementation details may have created a program where there is less incentive to trade than originally believed.

Briefly mentioned here are the expectations about regulatory and transactions costs when administrative and economic instruments are compared. Some analysts have expected that market based approaches are less expensive to implement. The United States experience so far is only anecdotal. The size and effort to develop the regulations necessary to define the market are comparable to those of command and control regulations. There does not appear to be evidence that market based instruments, particularly when used in conjunction with administrative methods, reduce the cost of implementing the policy.

Various participants have reacted strongly to the flexibility provided by economic instruments in air pollution control. The media and environmental groups have remained skeptical about such approaches. The first bilateral trades of SO2 generated some critical public press. In that regard, auctions such as those implemented for the RECLAIM program may benefit industry by making it more difficult to determine who the buyers and sellers were.

An important part of the comparison of administrative and economic instruments is that while administrative methods may appear in close to their pure form, economic instruments are typically used in combination with administrative methods in the United States. Thus the implementation of economic instruments achieves some cost savings, limited by the constraint of the overall administrative approach, while adding additional

bureaucratic and transactions costs. My belief is that the interaction, both in theory and in practice, of administrative and economic instruments has been understudied.

The major lessons from the air program of the United States is that various forms of trading have allowed some companies flexibility in their requirement to meet underlying administrative regulations. The cost savings, and possibly employment savings, have no doubt been important to some companies. The mixed form of instruments however, provides only a limited relief to the cost of stringent environmental regulation. Cost effectiveness, the theme of economic instruments, cannot be used as a replacement to the debate about the level of environmental quality that a society desires. Economics informs the debate about the desired level of environmental quality through the use of benefit-cost analysis. The choice between economic and administrative instruments as discussed here can say nothing about the desired level of environmental quality, only how to achieve the desired level at least cost.

Water emissions/effluent

Economic instruments have been tried in only a few instances for water pollution control in the United States. The ability to trade emissions within a watershed has been tried in several locations, most noticeably at the Fox River in Wisconsin and at Dillon Reservoir in Colorado. Each of these programs had expectations of significant cost savings compared to administrative methods. Those significant cost savings failed to materialize. The reasons given generally include the limited duration of property rights that were tradable at Fox River and the less than expected demand for emissions control at Dillon Reservoir.

In contrast to these two cases where economic approaches added little to the administrative approach, the "steel water bubble" policy that allowed intra-plant trades only in the iron and steel industry appears to have generated some measurable cost savings (Industrial Economics, 1994.) In the technologically based effluent guidelines of

the U.S. EPA, individual iron and steel facilities with more than one water outfall could overcomply at one outfall and undercomply at another.

Of 443 facilities covered by the rule, 208 had only one outfall and so were not potential participants. In addition, some governmental regions of the country appeared to support the bubble policy more strongly than others. However, since 1982, ten of the multiple outfall facilities used the bubble policy and cost savings data are available for 7 of the facilities. In aggregate, the seven facilities studied are estimated to have saved $122.7 million (present value) in 1993 dollars. This saving of just over $17.5 million dollars per facility can clearly be important to an individual site. Environmentally, the intra-plant trades involved meeting requirements related to total suspended solids, oil and grease, lead and zinc.

C. Instruments applied to the phase out of materials

Both a trading approach and a charges approach have been used temporarily to affect the transition to a strict standard. Although each case, the phase down of lead in gasoline and the phase out of CFC production, can be considered an air pollution issue they can also be considered as policies aimed at material inputs. In the case of lead, refiners were allowed to freely trade lead for 5 years at which time each refinery must the final regulatory standards (Kerr, 1994). Trading was unmonitored until the end of the year when refineries must demonstrate that they held a sufficient number of credits for their production. The cost savings estimates frequently cited for this program of $228 million were only for one part, the ability to "bank" reductions between 1985 and 1987. It is not known how much was actually saved by banking or by the larger and longer lasting trading program. The large activity in the market, where approximately 38 percent of the available rights were traded, with approximately one-third of refineries trading each quarter (Kerr, p. 40), has suggested that the forecasted savings from banking might

have been met. In this case, the regulatory burden was also relatively light on both the companies and on government. The trading program was ended on the date that all refineries had to comply with the final regulations.

Even less attention has been paid to the use of a charge system during the phase out period of CFC's required by the Montreal Protocol. The United States however, quickly implemented a tax approximately equal to 30 percent of the price of CFC's. The use of CFC's quickly declined as some firms adopted closed loop recycling systems and other changes to reduce the use of CFC's even while looking for ways to meet the elimination of CFC's as required by law. This more rapid than expected phase out was an element in the unilateral acceleration of the phase out deadline by the United States. Although cost savings evidence is not available, the behavior is clearly consistent with that expected from the use of charges, in this case also driven by the longer term requirement that CFC's be phased out completely.

IV. Lessons learned from comparing US administrative and economic instruments

- Economic instruments have generated the same level of improvement as administrative approaches. This criteria has been built into the design of some economic instrument programs.

- Actual cost savings can be significant to individual companies. This has been demonstrated in cases involving air and water emissions and phasing out material inputs.

- The largest actual cost savings to companies in the U.S. have come from an ability to make internal trades to meet a standard for an entire plant.

- The total cost savings may have been somewhat less than ten percent of the cost of the stationary source air emissions program.

- Economic approaches do not seem to have a direct effect on technological change although the recent interest in pollution prevention that pays may be an indirect impact of administrative and economic instruments.

• Actual cost savings are likely to be significantly less in total than the maximum cost savings predicted from a pure economic instrument in a world with no transactions costs. This has been demonstrated in simulation models and in the level of observed use of economic instruments.

• Economic instruments can succeed or fail. Their ability to deliver cost savings depends on the design of the program, especially the way that the economic instrument interact with other requirements imposed by administrative standards. Savings will be greater the greater is the certainty and the flexibility given to a company.

• Public interest in implementation is likely to be driven by very local concerns and the benefits of economic instruments may seem very abstract. Discussions in the RECLAIM program about job savings may be politically important to the public.

• The allocation of tradable permits to industry by "grandfathering" or the use of a tax credits with pollution taxes may be politically important to industry.

• The choice among economic instruments cannot replace the debate about the desired level of environmental quality. Economics can inform that debate through the application of benefit cost analysis.

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APPENDICES FOLLOW