



DEVELOPING A MARKET IN EMISSION CREDITS INCREMENTALLY: AN 'OPEN MARKET' PARADIGM FOR MARKET-BASED POLLUTION CONTROL

By Richard E. Ayres

Market-based pollution control systems are increasingly accepted as a means of purchasing a chosen level of environmental quality less expensively than with regulatory systems alone.¹ The 1990 Clean Air Act Amendments embraced the concept in its major programs and established a detailed sulfur dioxide trading program in the law.

Market-based systems also deliver environmental and political benefits that are less well appreciated. When the cost of pollution control is subject to marketplace forces and opportunities, innovators who produce less expensive or more effective pollution control techniques will be rewarded. These technological innovations, in turn, offer policy makers the option to pursue more aggressive environmental policy.

For the past 25 years, every legislative and regulatory initiative to protect environmental quality has been met with concerns that it would close down factories and put people out of work. While supporters of greater protection pointed to low average costs of environmental controls, opponents pointed to the facilities with the highest costs of compliance to persuade legislators and regulators to adopt more lenient standards. Market-based regulation can blunt this conflict—giving facilities with the highest cost of compliance a cheaper alternative that will achieve equivalent emission reductions, satisfying both the public and private interests.

The existence of a cheaper alternative also gives regulators a greater ability to resist pressure for case-by-case relaxation of cleanup standards at facilities where the marginal cost of compliance is high. Today, such situations are usually handled by issuing variances, "alternative emission limitations," or the like—in effect, solving an economic problem for the source by accepting lower air quality for the public. Market-based systems can provide a less expensive compliance alternative that protects the public interest in improved air quality.

Market-based systems also seem more acceptable to the regulated community, perhaps largely because they offer the potential for less expensive environmental regulation.² This acceptance has translated into greater political support for market-based pollution control systems than for previous environmental regulation.

To succeed, a market-based system must be sufficiently flexible to accommodate the rapid flux of commercial transactions. It must also assure that the public interest in achieving healthful air quality is protected. This latter consideration raises a host of subissues—appropriate "baselines," proper definition of the airshed within which trading may take place, proper accounting for emission credits, how to assure the system is enforceable, and how to divide the benefits of trading between emitters and the public.

It comes as no surprise, therefore, that implementing market-based systems that deliver on their promise is proving to be a difficult task. Regulators already are faced with a long list of familiar challenges—rewriting state implementation plans to meet the deadlines and strictures of the 1990

amendments, designing or redesigning comprehensive permit programs, implementing toxic emission controls, increasing enforcement capability, and so on. Market-based programs have the handicap of being unfamiliar and largely untried. There is not even a common vocabulary for discussing them. In addition, the accounting requirements of the market-based systems appear to most regulators to increase rather than reduce their burden.

An incrementally developed "open market" system built on today's command-and-control policies can ease both the practical difficulties and the fears associated with implementing a market-based program. By starting a program with specific transactions and building the system incrementally in a bottom up or "open" way, all parties can develop knowledge and confidence with little risk to overall program objectives. Best of all an effective program can be implemented quickly, yielding emission control results far sooner than other programs. Understanding why requires an understanding of the alternatives and some definition of the basic terms of market-based systems.

EPA has encouraged "emission trading" since the late 1970s. The EPA "bubble,"³ "netting" and "offset" programs allow certain kinds of trading of emission reduction obligations within the pre-existing regulatory structure.⁴ These programs use the existing command-and-control regulations as a baseline for trading. Emission sources earn benefits in the form of avoiding time- and resource-consuming government processes, and lower compliance costs, by reducing emission rates below mandated requirements.

Under the 1990 amendments to the Clean Air Act, several prototypes of market-based systems are being developed and implemented.

The acid rain control program⁵ is the first major federal pollution control program based on market principles. Under it, EPA will distribute rights to emit 8.9 million tons of SO₂ annually (8.9 million "allowances") to owners of utility units that existed in 1990, approximately half the 1990 annual emissions. Utilities will be free to buy, sell or trade allowances, enabling the market to achieve the statutory goal at least cost. Compliance is achieved when a utility provides EPA with allowances equal its total annual emissions of SO₂.

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New units receive no allowances from the government, and must purchase sufficient allowances to cover their emissions from owners of units that existed in 1990.

A similar system has been adopted by the South Coast Air Quality Management District, after more than two years of discussion. The SCAQMD system, called RECLAIM,⁷ replaces command-and-control regulation for emissions of SO₂ and nitrogen oxides for covered sources. Unfortunately, after a two-year regulatory negotiation, fewer than 400 sources chose to participate in the system.

Massachusetts air pollution authorities have adopted a regulation to permit trading in several pollutants using "emission credits," created by reducing emissions to levels below those required by law.⁸ While enlarging the scope of permissible trading beyond EPA's Emission Trading Policy Statement, the Massachusetts regulation may be seen as a natural progression from it.

Illinois has recently issued a "draft proposal" design for an emissions trading system for volatile organic emissions. This proposal appears to incorporate features of both the "open" and "closed" market models described in this paper.⁹

An open market system has been developed in Tulsa, Okla. It is built up through case-by-case transactions. This system offers substantial advantages over either of the other two kinds of systems for dealing with regional smog problems.

Rather than replacing the existing command-and-control structure, the open market system provides more flexible compliance options to achieve greater economic efficiency. Because it uses the current regulatory structure as a starting point, it can be implemented more quickly and with less preliminary measurement, analysis, and controversy than other approaches. Because it can provide a control alternative now for facilities where the cost of compliance with current regulations is high, or where compliance activities cannot be completed in time to meet deadlines, it can reduce pressure for regulatory rollbacks and deadline extensions. Since emission rights are earned by making reductions in emissions, it levels the competitive playing field—eliminating the windfall to existing sources and unfairness to new sources inherent in systems like the acid rain and RECLAIM programs. And because the open market system easily integrates area and mobile sources, it can bring the full emission inventory into the regulatory structure.

The Open Market Trading System

In the open market system, emitting entities with low costs of control are encouraged to create tradable "products" by achieving what EPA calls "surplus" emission reductions—i.e., by reducing emissions to levels lower than required under the applicable state implementation plan.¹⁰ Surplus emission reductions achieved over a particular length of time—"surplus discrete reductions" (SDRs)—measured in pounds or tons of pollution, can then be sold to entities with higher control cost structures. When recognized by governmental authorities, these SDRs become "emission reduction credits," which may be used to for compliance with emission control requirements elsewhere. While this sounds at first like trading under EPA's Emission Trading Policy Statement, the open market system departs from EPA's guidance in ways that significantly alter its nature and workability.

1. Notification. Before a facility owner or operator begins making SDRs, it submits a plan to the state agency describing its intended actions. This plan provides a summary description of the actions to be taken to create the SDRs¹¹—how they are to be achieved, the reason why they are surplus, and the monitoring and recordkeeping methods that will be employed to verify them. The plan is not an enforceable obligation. The

owner or operator may without risk decide not to reduce emissions, or change the plan to curtail emissions less or in a different manner. Because the plan is not enforceable, companies will be encouraged to try out innovative emission reduction techniques, and to test the market for potential buyers.

2. Posting. When an owner or operator curtails emissions in accord with the plan for a period of time, the resulting SDRs are posted on an "SDR electronic bulletin board." Since they have as yet no official recognition, no revision of a SIP or permit is necessary. Likewise, SDRs are freely transferable upon nothing more than a notice to the SDR electronic bulletin board including seller, buyer, and price.

3. Creation of Surplus Discrete Reductions. SDRs are created by cutting emissions below a baseline—the lesser of the currently applicable state emission limitation or the actual emissions in a base year. SDRs are expressed in tons or other unit of mass, derived by multiplying the difference between the baseline emission limitation applicable to the source and the lower emission rate(s) actually achieved, times the length of time the source achieved the lower emission rate(s).¹² For example, a source of NO_x subject to an emission limitation of 200 pounds per hour might reduce emissions to 100 pounds per hour. If the source operated 75 percent of the hours in the year at 100 pounds per hour, it would create 328.5 tons of NO_x SDRs each year (6,570 hours x 100 pounds/hour divided by 2,000 pounds/ton = 328.5 tons).¹³

4. Banking of Surplus Discrete Reductions. SDRs, by their nature, are retained, or "banked," to be used later.¹⁴ Depending on state policy, they may have a perpetual or limited life. The longer the life, the greater the probability that SDRs stored in bank accounts will, like money kept out of circulation, essentially become a continuously replenished permanent reduction in pollutant emissions.

SDRs are always the result of curtailing emissions beyond the applicable requirements. If a source's baseline emission limitation changes because of changes in State regulations, it does not affect SDRs created by past actions. But any future SDRs may only be created by reducing emissions below the new baseline. The baseline for generating SDRs, in other words, is always the currently applicable emission limitation.

5. Transactions in Surplus Discrete Reductions. In an open market, transactions between private parties will occur in SDRs. Creators and buyers can transact directly, using the SDR electronic bulletin board or brokers to locate each other. Private investors in the SDR market can pay sources to undertake actions that will create SDRs, holding them in inventory while seeking buyers. This function may be particularly useful because variations in state regulations with regard to recognition of credits¹⁵ will mean that SDR "products" will take different forms.

6. Use of Surplus Discrete Reductions for Compliance. SDRs provide an additional compliance device for emission sources—a "software" alternative to traditional "hardware" emission control systems. State and federal oversight of SDR use for compliance also parallels traditional compliance oversight practices. At the time of compliance evaluation by the pollution control authorities SDRs are offered by the emitter for evaluation by the state, along with the usual monitoring records, operating date, or other records used to establish compliance. For example, permits often require regular reporting of emissions to authorities. At that time, the state recognizes the SDRs as credits and counts them towards the facility's compliance obligation.

While the concept of retrospective credit creation is a departure from emission trading systems developed under the EPA Emission Trading Policy Statement, it is critical to

the development of a commercially viable market system. A system where government must recognize credits before they can be used is guaranteed to fail commercially at its weakest link—the overworked civil servant who cannot process the volume of transactions involved fast enough to keep pace with market needs.

A “net improvement assessment” may be subtracted from all surplus discrete reductions by the government when credits are recognized, in order to assure a positive environmental effect from each transaction.¹⁴ A state may also adopt other rules that affect the convertibility of SDRs to credits. A state might, for example, grant credits at a discount for all SDRs used by a buyer from areas considered “downwind,” or from upwind areas considered too far away. These rules might be adopted formally, or developed on a case-by-case basis in the context of considering specific SDRs proffered by sources to satisfy their compliance obligations.

7. Environmental Review. The quantity of credits resulting from a given SDR action is subject to revision upward or downward by the state for a period of time after the action occurs (three years in the Tulsa system) to allow adjustment for improved scientific understanding. After that, the number of credits resulting from that action becomes fixed. To change the quantity of credits recognized, the government must give notice to both the SDR creator and credit user. An administrative appeal process is provided.

This open market system offers substantial advantages over other market-based systems now in place, particularly for dealing with the pollutants that are responsible for regional smog. It offers an improved potential for a commercially viable marketplace within a structure that assures greater protection of the public interest in healthful air quality. A look at the alternative market-based systems will show why.

Other Models

‘Hybrid’ Command-and-Control Systems

Since EPA’s 1979 “bubble” rule, the agency has attempted to achieve greater flexibility and reduce the cost of compliance with command and control regulations. The resulting emission trading programs at the state level may be characterized as “hybrids”—command-and-control structures with market-like elements grafted onto them. Hybrid systems are a primitive stage in the development of a market. In effect, they are barter systems of exchange, where potential buyers and sellers must find partners whose needs are mirror images of their own. Since hybrid systems lack a medium of exchange, transaction costs are high, and true arms-length trading is difficult. And because they impose cumbersome administrative requirements, they have failed to create a vigorous market or to achieve the potential economic benefits of market-based systems.

In a hybrid system, those subject to specific emission reduction requirements are allowed to propose swaps of command and control emission limitations. Under “netting” and “offset” programs, sources can avoid certain regulatory processes and otherwise-applicable emission control requirements by setting off their own emissions against emission reductions from other sources within the same polluted metropolitan area.¹⁵ Under the “bubble” rule, factory owners may avoid some otherwise-applicable requirements by making additional emission reductions at other air pollution sources within the same factory.

Hybrid systems place emission trading under tight regulatory supervision, retaining most of the regulatory machinery of the command-and-control system. They thus greatly increase the workload for regulators. Regulators express con-

cern that the opportunity to depart from the clear regulatory command not be used as an excuse for evading pollution control requirements. For example, under EPA’s “bubble,” “netting,” and “offset” requirements, a proposed emissions trade must be incorporated into a “compliance instrument which is legally binding and practically enforceable by EPA.”¹⁶ Given the complexity of the associated requirements, it is hardly surprising that there have been few transactions, and that they tend to be within a single corporate entity.

While more comprehensive, the recently adopted Massachusetts emission trading system retains many of the features of the federal rules. The Massachusetts regulation includes a medium of exchange—“emission credits”—but transactions in Massachusetts emission credits still require that both parties obtain pre-approval by the state and change their permits, with attendant risks of drawn-out administrative review.

The administrative complexity of hybrid systems is designed to assure state and federal supervision and enforcement at both ends of an emissions transaction.¹⁷ “Banking” of credits and other such logical aspects of a market system, while sometimes permitted, cause discomfort. Costs are high. The requirement to make legally binding commitments at the outset leaves little room for the uncertainties and corrections based on experience that are a part of a typical commercial situation. And because they are cumbersome, hybrid systems also fail to maximize the market’s potential to stimulate technological innovation.

‘Closed Market’ Systems

The new acid rain and RECLAIM systems are examples of what might be called “closed market” systems. These “top down” systems offer the flexibility needed to encourage transactions, in a structure that defines the public interest and assures enforceability. But they have a number of disadvantages when applied to the ozone smog problem.

The parameters of a closed market must be established legislatively *ab initio* (either by the Legislature or the regulatory agency). In the case of acid rain, for example, Congress wrote into federal law the policy objective of limiting utility emissions of sulfur oxides to not more than 8.9 million tons annually—about 60 percent of pre-existing level—based on an estimate of the threshold damage to natural resources. Accordingly, the number of emission “allowances” available for transactions will be limited to 8.9 million tons annually when the program is fully operational.

A closed market system provides a highly flexible framework for commercial transactions, in effect substituting entirely for a command and control regulatory structure. Once the parameters of the market are established, transactions are almost entirely free of government involvement. In the acid rain program, purchases and sales of allowances must be registered with the government, and sources must undertake monitoring and recordkeeping consistent with EPA regulations, but buyers and sellers need not worry about revising permits or SIPs.

Emitters are, of course, answerable to the government, but instead of being obliged to achieve any specified emission rate or amount, they must only “pay for” their total annual emissions with an equal number of allowances. The potential benefits of creating such a medium of exchange, compared to the hybrid barter system, are analogous to those that have flowed from the development of money in the economy at large.

A closed market system offers greatly increased opportunities to capture the economic benefits of the market when

compared with hybrid systems. A closed market system also provides a strong stimulus for developing new technology. Any innovation that lowers control costs will find a ready market.

But creating a closed market system requires a great deal of knowledge about the pollution problem and the sources of pollution. To identify the goal, the government must understand, or estimate, the damage function²⁰ for the pollutant and its relationship to pollutant emissions. To know how much emission reduction is necessary, it must know the current total emissions of the pollutant in the airshed of concern. To allocate emission rights, it must also know to some degree of certainty all sources of the current emissions and how much each emits.²¹ None of this is well known today for the regional smog problem. Learning it and making the allocations would be time consuming, costly, and politically difficult.

Since the participants in the closed market are a limited universe, the closed market system may not capture the full economic benefits available from a broader market structure. For example, the Ozone Transport Commission has recently proposed to adopt a closed market system in the Northeastern states that would include utility sources of NOx. Although OTC has endorsed broadening the market as an objective, it is unclear how motor vehicles, off-road engines, and "area sources"—together currently accounting for half the NOx emissions in the Northeast—can be brought into the proposed system.

Because a closed market must be created all at once, it also requires a great deal of political consensus to create one. Creating the acid rain program took 10 years, and the priority attention of the president of the United States. In Los Angeles, unable to achieve the needed level of political consensus, the South Coast Air Quality Management District was eventually forced to scale back its RECLAIM program to cover less than 400 of the tens of thousands of industrial emitters in the Los Angeles Basin, to limit the pollutants covered, and to ignore mobile sources, which are the largest contributors to pollution in the basin.²²

A closed market system also carries substantial potential for political backlash. In creating a closed market, the government in effect monetizes a highly valuable publicly owned resource ("air resources") and grants this asset (e.g., as SO₂ "allowances") without cost to owners of existing pollution sources, using an allocation formula that rewards those who emitted the most pollution at the time of the system's creation. Such a system is vulnerable to the charge of a "giveaway" of public natural resources. Moreover, while "vested" polluters are granted pollution rights by gift from the government free of charge, new players—no matter how clean—must buy their way into the market. Thus "polluters" obtain a property right in past pollution, while a new barrier is raised to cleaner companies and technologies.²³

While a closed market system appeals to many economists,²⁴ it is apparent that neither the information nor the political consensus exists to create a such a system to deal with the regional smog problems of the Northeast or other multistate regions. Accumulating it would take time, money, personnel, and an unprecedented level of regional cooperation. Thus the question is whether the equivalent benefits can be obtained with fewer resources incrementally through an open market.

Open Market: A Practical Alternative

An open market system carries advantages in simplicity, structure, and ease of creation. It is consistent with the limitations in our current knowledge, and with our current

control approach. Unlike a closed market, regulators do not have to stake the public health on a once-and-for-all judgment about how many tons of emissions of smog precursor pollutants to allow that, once made, will become embedded in a property rights system. In fact, the open market can be used to build up the information on sources and emissions, and the experience with trading, that may eventually permit adoption of a closed market system for smog precursors.

Commercial Viability

The benefits of emission transactions will be felt only if a vigorous market develops. The authors of the acid rain control program understood that protracted governmental approval processes will stifle a commercial market, and consequently drafted a program that allows transactions among emitters to occur with no more than notice to the government. This insight is incorporated in the open market system, which allows emitters to trade in surplus discrete reductions with no more than notice to regulatory officials. The state need not supervise the creation or sale of SDRs, since these may not be used for compliance. Only when a source wishes to translate SDRs to credits will the state be involved.

Separating the steps of generating and trading, on the one hand, from use and official recognition, on the other, separates the commercial and environmental policy aspects of the transaction, and avoids weighing down the commercial transaction with the costs that have hobbled the hybrid systems. It allows the parties to a commercial transaction to explore the reality of the emission reductions through the kneading process typical of business negotiations, while preserving for the government the role of protecting public health. It also avoids forcing the government into authorizing permanent changes in emissions limitations on a prospective basis, as in bubble and offset transactions.

Protection of the Public Interest: Enforceability

In comparison to the current hybrid systems, an open market system provides far greater ability to assure that the use of emission credits will in fact yield the promised net benefit to the public interest in cleaner air.

In current hybrid systems, the government assumes all responsibility for assuring that balancing emission reductions are made. The transaction must be reflected in changes in each permit, and in the state implementation plan. Despite this seeming rigor, the most common criticism of hybrid systems is that the government does not have the enforcement capabilities to be sure the emission reductions that support the trade actually have occurred, and neither the creator nor the user has any ongoing interest in continuing validity once the state has certified.

By placing the burden on the buyer to demonstrate the genuineness of SDRs in order to be able to receive credit towards compliance, the open market system in effect deputizes the buyer's commercial interest to assure the environment is protected. The government can exchange the role of policeman for the role of judge, requiring whatever degree of proof it wishes for the buyer before conferring credits.

Further, the open market system makes the government's judgment about the reductions retrospective, not prospective. In today's hybrid systems, the government issues a prospective permit that usually permanently relaxes the emission requirements for the buyer, based on representations by the seller that it will continue to curtail emissions in the future. Once the permit is issued, however, the seller no longer has a commercial incentive to maintain reduced emissions, and the government rarely has the human resources to assure compliance. Moreover, if the government concludes that the

promised emission reductions are not being made, it can vindicate the public interest only through an enforcement action against the creator (even if the creator is now a bankrupt, or no longer in the state), or go through the cumbersome process of revising the permit and often the SIP.

The open market system provides integral adjustment mechanisms for taking into account improvements in science, pollution models, and measurement systems. Government recognition of a block of credits, based on SDRs created earlier, unlike approval of offsets or bubbles under the EPA trading policy, does not bind the government to issue credits in the future based on continuing the same behavior. If new science indicates tighter emission limitations, those who wish to create SDRs must curtail emissions further. In addition, the government retains the right to adjust the quantity of credits for a specified length of time after they are created. The three year "look back" period for each block of credits means that pollution control officials may adjust their credit award based on new data or understanding.

Protection Of Public Interest: Environmental Benefits

An open market system will provide important environmental benefits compared to both the current command-and-control structure and the closed market systems.

First, like a closed market, an open market system will reveal the real cost of environmental cleanup. As transactions occur, price information will be generated that will reveal the true cost curve for pollution control measures, including the correct marginal cost of reducing emissions. This information will allow regulators to make far more informed policy decisions with regard to pollution reduction goals. Increased information about the costs of achieving emissions reductions required in current SIPs would allow policy-makers to consider more realistically the costs and benefits of proposals for further reductions. Accurate price information will also limit the political dimension of pollution control decisions. When the prices of pollution controls are known, there will be no more room for the kind of highly politicized disagreements about the cost of proposed policies that are a staple of today's environmental debates.

Second, states will be in a position to obtain for public use a portion of the SDRs when recognizing credits. Such a policy could be written into the SIP as a control strategy for attaining "reasonable further progress" goals. In any case, the state air pollution officials will determine how much they wish to use the economic incentives of potential SDR trades to generate additional emission reductions to be used to protect public health.

Third, many sources will find it useful to hold SDRs as compliance "insurance" to avoid a violation when they have upsets, breakdowns, or other situations that prevent meeting their emission limitations. SDRs held for "insurance" represent a continuously replenished margin of pollution reductions that are effectively permanent. With SDRs, exceedances of emission limitations are compensated for by reductions already made elsewhere; without SDRs, while violations may be punished, no emission reductions are made to compensate the public for the non-compliance.

Finally the open market system protects the public ownership of the nation's air resources. In an open market system, there are no windfalls or "giveaways" of air resources to those present at the creation of the market. The public retains ownership of its air resources. Rights to air resources can be obtained by private parties only by emission reductions. To obtain them (in the form of credits), parties must invest in measures that reduce pollution, either directly, or indirectly through the purchase of SDRs from others in the system. And

the open market provides a level playing field for all participants: New players earn credits in the same way as those who were present at the outset of the market.

Protection of Public Interest: Economic Benefits

The open market system can achieve the economic benefits of a closed market system, but in an incremental fashion that maximizes flexibility for emission sources, while providing assurance to regulators that the public interest in less air pollution will be served.

First, because it is built on existing command-and-control regulations, rather than replacing them, the open market system provides sources more choice. They need not join the market all at once, or ever, unless they want to.

Second, unlike a closed market, an open market can obtain the economic benefits that come with including the greatest number of sources within the potential market. Closed markets, by their nature, are limited to sources with permits: Every source that wishes to trade must be brought within the closed system, and provided with the closed market currency (e.g., allowances) in order to trade. By contrast, an open market can accommodate transactions between any emitters. The significance of this difference is apparent from the accompanying charts, which detail the sources of emissions in the recent past and future in the northeastern United States and the Los Angeles Basin.

As can be seen from the charts, unpermitted sources (area sources, off-road sources, and on-road vehicles) currently account for four-fifths of volatile organic compounds (VOCs)—or reactive organic compounds (ROGs) in California—and will continue to do so in the future. In the South Coast Air Quality Management District, unpermitted sources account for 84 percent of NOx emissions now, rising to 90 percent by 2010. Even in the Northeast, where "point sources" (largely utility boilers) now account for almost half of NOx emissions, implementation of the state implementation plans called for by the amended Clean Air Act will cut that share in half.

Moreover, a market confined to permitted sources does not reach the sources with the greatest disparities in compliance costs (or "arbitrage"), where the greatest potential economic savings can be made. A closed market in NOx allowances will not achieve much of the potential economic benefits if it includes utilities in the Northeast, who have very large potential emission reductions at marginal costs of \$100 to \$2,500 per ton, but excludes motor vehicles with marginal costs that auto manufacturers say will exceed \$50,000 per ton.

Fourth, an open market offers a framework that can capture the economic benefits of interstate trading without requiring prior regional adoption of a formal, uniform trading structure. The prolonged battles over the acid rain reduction program and California's RECLAIM program demonstrate how difficult it is to put a system in place, even in a single jurisdiction, when it must be taken all at once or not at all. Working incrementally from the bottom up in an open market structure can avoid the prolonged regional political process that would otherwise be required in the Northeast, Midwest, and Gulf Coast, the areas with the worst multistate smog problems, to adopt a uniform regulatory structure. The advantage of this is obvious in light of the continuing struggle over adopting uniform reasonably available control technology for NOx, and the low-emission vehicle program in the Northeast.

In sum, compared with a closed market, an open market can capture more of the potential economic efficiency benefits available through emission transactions. It can drastical-

ly cut the transaction costs that hobble the current hybrid systems while providing equal or greater assurance of the integrity of trades.

Establishing The Program's Environmental Objectives

Based on this comparison, it seems apparent that an open market system offers some substantial and immediate benefits as a means of achieving reductions in emissions in our major metropolitan areas at lower economic cost. Clearly, however, there is another issue: Under which system are we more likely to attain our air quality goal—eliminating exposure to levels of pollutants that exceed the federal air quality standards? The answer to this question requires some consideration of the elements common to public programs to control air pollution.

In designing a pollution abatement program, there are three conceptually separate steps. First, the public authorities must choose the environmental quality goal. In the Clean Air Act, Congress specified this goal in terms of air quality—concentrations of pollutants in the general outdoor air.²⁴ Once air quality standards are established, the government must also determine the emission reduction objective that will achieve the air quality goal. The third step is to specify the regulatory program by which the emission reduction objective will be achieved.

While the choice between open and closed market systems would appear to be a choice between regulatory programs, it also implies an important difference in how the emission reduction objectives of the program are established.

Emission reduction objectives can be established, in theory, in either of two ways—by determining a degree of reductions from current emissions or budget, that will achieve the required air quality, or by placing a limit on the total aggregate emissions, or cap, in an area that will accomplish the same result. In theory, these are simply two different ways of expressing the same idea, as the diagram illustrates.

The open market system is based on emission goals set in the first of these ways. Under current regulations, these requirements are established in terms of what is thought to be technologically achievable—through RACT, BACT, and the like. An open market can be built upon these technology requirements, or would be equally compatible with emission reduction requirements based on other rationales that go beyond RACT. Closed systems, obviously, use the second method—aggregating allowable emissions from present polluters into an explicit emissions “cap” or “budget” in order to draw the initial specifications of the program.

The failure of the current reductions approach to yield the air quality objectives in urban areas has spurred interest in applying the cap concept in a closed market system to these pollutants. For reasons outlined above, this does not seem generally practical for dealing with urban ozone pollution. Lacking certainty about the total emissions of hydrocarbons and nitrogen oxides, the sources of those emissions, the complex chemical reactions that form ozone in the atmosphere, and even the wind patterns that move pollution from emission points to breathers,²⁵ we do not currently have the information needed to responsibly establish a general cap on emissions for these pollutants, nor do we know the appropriate geographical area for the cap. A cap on one side of a river and no controls on the other side of the river might be acceptable to regulators, but it will not be respected by the wind.

We have asserted that an open market system will over time generate information to fill some of these gaps. By providing an economic incentive for sources to honestly

identify emissions in order to create emission credits, it will generate far better emission inventories. But its success at achieving air quality objectives depends on whether the public authorities have imposed a sufficient number and stringency of emission reduction requirements.

If substantial additional emission reductions are to be adopted, at this stage pragmatism may be the best approach. In the Northeast such an approach might include the concept of an industrywide regional emissions budget on emissions of NO_x from large utility boilers (and perhaps some large industrial facilities) as part of a larger open market. Sources subject to the budget would be able to participate in an open market, engaging in transactions with sources subject to RACT or other traditional forms of emission limitation.²⁶

Other Policy Issues

An open market system promises to provide substantial economic and environmental benefits. As with other market-based systems, however, it requires addressing a number of significant policy issues. Many of these are identified in EPA's Economic Incentive Program rules and previous EPA policy statements on emission trading. We highlight four of particular significance for the development of open market systems to attack regional ozone smog problems.²⁷

Size Of The Market

In general, the larger the market, the more economic benefits are available. For this reason, greater benefits are available if interstate transactions are permitted within smog regions such as the Northeast.

State policy makers have been reluctant to accept interstate emission transactions under today's hybrid systems. Despite EPA regulations requiring permit and SIP revisions for both parties to such a transaction, hybrid systems in fact provide almost no leverage to the user state to assure that the promised reductions are made in the seller state. In such a system, the user state has only two means of redress, neither of which is likely to be effective—a petition to EPA to enforce the seller's state SIP against the seller; and an enforcement suit against the seller in the federal district court where the seller is located.

An open market system provides policy makers a mechanism for interstate emission trading that gives states a practical means to protect their citizens' health. Since state action is necessary to create a credit, the state will have complete power to obtain whatever verification it wishes for proffered out-of-state SDRs. In effect, through the contractual arrangements between the private parties, the state will acquire a kind of “long arm jurisdiction” that should give markedly more comfort that the more intrusive, but less effective, arrangements under today's hybrid systems.

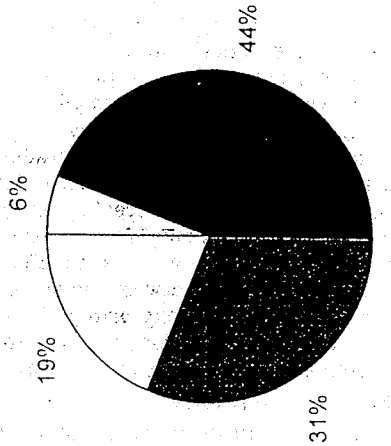
Baseline For Trading

In any emission trading system, the government establishes the environmental objective. In the acid rain program, this objective is to limit annual SO₂ emissions to 8.9 million tons nationally. This becomes a trading baseline: Only 8.9 million allowances are made available for trading in any given year. In hybrid and open market systems, state implementation plans become (at least initially) the baseline: Emitters must create “surplus” emission reductions in order to trade.

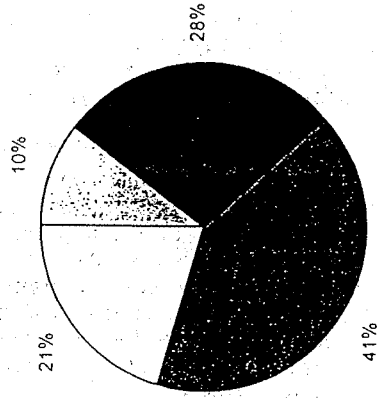
This presents an issue for policy-makers. Currently, virtually all SIP requirements have been established in the context of a command-and-control structure. Many would argue that, as a result, these requirements have been compromised in response to the sources with the highest incremental costs of control. Allowing emission transactions to occur against this

Total Emissions of Reactive Organic Gases and NOx in the South Coast Air Basin, 1987 and 2010

ROG

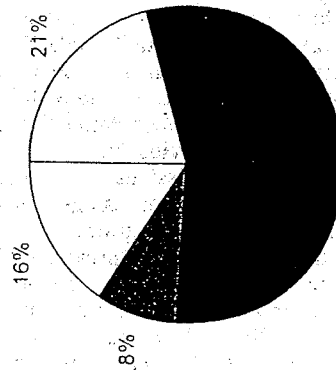


Total = 1,380 tpd
1987

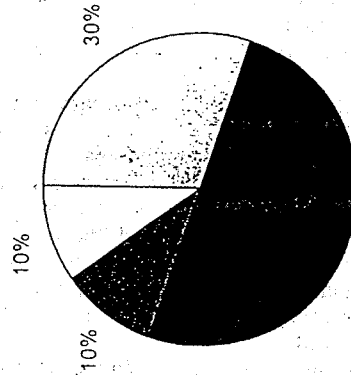


Total = 1,070 tpd
2010

NOX



Total = 1,200 tpd
1987



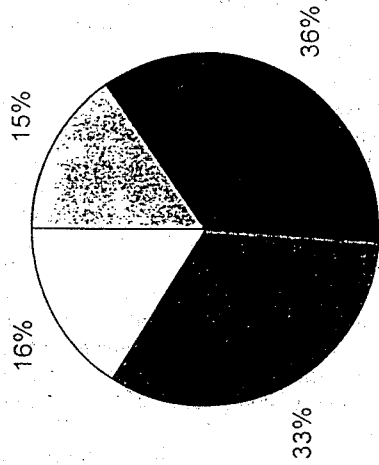
Total = 1,000 tpd
2010



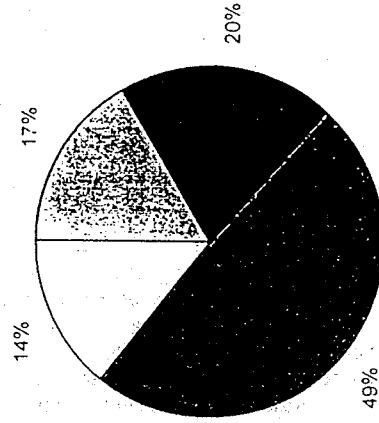
Total Emissions of VOCs and NOx in the Ozone Transport Region, 1990 and 2005



VOCs

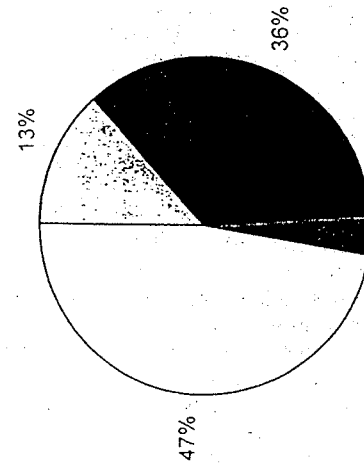


Total = 9,600 tpd
1990

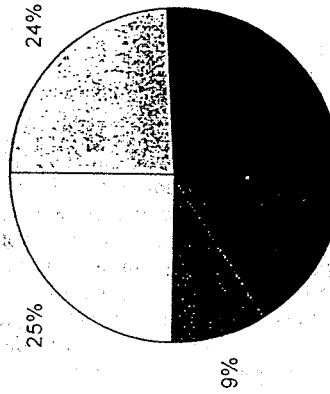


Total = 7,670 tpd
2005

NOx



Total = 11,080 tpd
1990



Total = 5,924 tpd
2005



compromised baseline, they argue, is inappropriate; a baseline for trading should be set in the context of a trading regime, where it could be based on the average cost of control for the industry segment in question. Otherwise, the benefits of trading go entirely to industry rather than to the public.

The issue posed here is addressed under the rubric of "benefit sharing" in the recent EPA Economic Incentive Program regulations. There EPA opined that economic savings in compliance costs resulting from EIPs adopted as part of SIPs³⁰ should be shared between emitters (in lower costs) and the public (in lowered pollution). Rejecting the view that regulated sources should retain only as much savings as is sufficient to maintain the incentive to participate in the EIP, the agency left it to the states to decide how they would divide the benefits between the emitters and the public interest in reaching attainment more quickly.

Trading 'Upwind'

Some point to the possibility that through emission transactions, emissions from downwind parties will in effect be transferred upwind, exposing more people to pollution.³¹ This concern implies an assumption that regulators will not adopt trading policies to manage emissions transactions consistent with scientific understanding of air pollution. Effective policy instruments are available to prevent such upwind trading. States may prohibit or discount credit requests for transactions that would relocate emissions further upwind under prevailing wind patterns, depending on their own assessment of the science.

Maintaining 'Reasonable Further Progress'

Under the Clean Air Act, state air plans for most major metropolitan areas must provide for "reasonable further progress" towards achieving federal air quality standards by demonstrating aggregate emission reductions of at least 3 percent per year.³² It is said that if banking of emission SDRs resulting from early emission reductions is permitted, there is a risk that they may be used in the future in a way that would interfere with achieving the statutory "reasonable further progress" requirement. Hence states that adopt trading systems should, it is argued, be required to amend their SIPs to require additional reductions each year below reasonable further progress to protect against this possibility.

The suggested risk of SDR "dumping" in a given year would appear to be overblown. Those who raise this issue focus on utility NO_x emissions, which might peak on a hot summer day in the Northeast when it is thought that the potential for high ozone concentrations is greatest. They picture that the utilities will use credits to allow excessive NO_x emissions at such a time. This argument ignores some important points. First, as noted above, even in the Northeast utilities are insignificant sources of VOC and account for only half of NO_x emissions, moving towards one-fourth in the next decade. There is no reason to assume emissions from other sources would tend to peak on hot summer days. Second, current command-and-control regulations do not limit utility emissions on such occasions. Current regulations limit only emission rates, not emissions. So adopting an open market system that translated these emission rate limits into limits on total tons of emissions would tend to limit "spikes" from utilities on hot days. Moreover, at any given time, the inventory of SDRs would represent only a small fraction of an area's emissions, so that even if it were drawn upon on a hot day, the increment of emissions added would be small.

What is clear is that initial emission reductions to create SDRs will take pollution out of the air that otherwise would be emitted. Thereafter, in a thriving market, banking and "spending" by different sources should largely balance each

other. So air quality should remain better than it otherwise would be in each sequential year, by approximately the amount of the initial early pollution reduction. Policy-makers could, of course, place limitations on the use of credits that would obviate any risk of SDR "dumping." Members of a task force of the organization of northeastern air regulators, the Northeastern States for Coordinated Air Use Management (NESCAUM), are considering measures to eliminate such a risk. While this is an understandable regulatory response, regulators would be wise to consider carefully whether the additional theoretical comfort such limitations might provide would outweigh the additional burdens they would place on the efficient operation of the marketplace.

How To Make An Open Market A Reality

In recent months there has been increasing discussion of the potential benefits of using market-based approaches to help solve the chronic urban air pollution problems of the Northeast and Great Lakes states. Some have advocated the creation of regional closed market systems patterned on the federal acid rain program. As pointed out previously, the sheer political difficulty of creating the political "big bang" necessary to build such a multistate structure is one of the strongest concerns about this idea.

By contrast, an open market system can largely be created incrementally by private entities if state and federal governments do not erect impassible regulatory barriers. Some of the major impediments to an open market have already been identified:

- ▶ **Cumbersome requirements for pre-approval** of both creation and use of surplus emission reductions stifle the commercial viability of a market system;
- ▶ **Limitations on intertemporal trading**, or "banking," discourage early reductions in emissions which provide one of the major benefits of emission transactions; and
- ▶ **Geographical limitations on transactions** that artificially limit the size and economic efficiency of the potential market.

Requiring a SIP revision for every transaction misconceives the role of SDRs, which are a compliance measure, not a change in the underlying obligations of the SIP.

In addition, no market-based system can succeed until certain critical defects in the current command-and-control structure can be cured. These defects are seen in sharp relief when the current system is examined from a trading perspective, but in fact they reveal its clay feet.

One defect is regulators' willingness to grant variances, by whatever name described, rather than enforce uniform emission reduction rules on sources with similar characteristics. Many states offer variances whenever a source shows that the costs of compliance at the source would exceed some pre-established cost per ton of pollution reduction. If such sources were instead required to comply using credits, it would provide the source with needed flexibility while protecting the public interest in cleaner air.

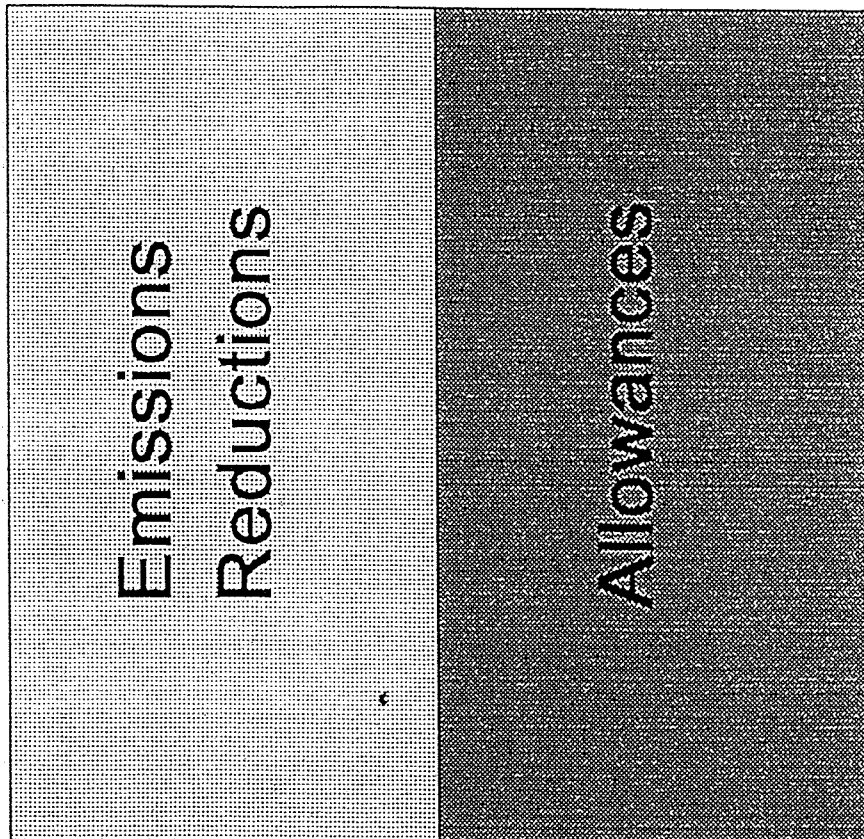
Another defect is the poor quality of emission information generated by today's command-and-control regulations and their monitoring, information, and enforcement structures. It is often assumed that command-and-control regulations produce greater certainty about emissions. Experience suggests that guesses, rules of thumb, and trusting the source often substitute for measurement in today's command-and-control systems. As a consequence, the fundamental data needed for a workable market system are often absent.

The primary objective is to allow, within the imperative of protecting the public interest, a market to be created by those who wish to engage in transactions. EPA's recent Economic

Reductions versus Allowances

1990

Inventory



1999

Requirement

"Cap" or "Budget"

Incentive Program regulations, and the agency's forthcoming guidance on banking, could open the door for this. But state regulators considering policies on emission transactions will need to incorporate certain basic principles into their programs to unleash the power of the market.

1. Transactions in Discrete Units. Regulators need to develop a new conception of what is traded in an emission transaction. The concept of trading as transfers of emission rate limitations into the indefinite future needs to be replaced with a concept of transactions in discrete units (e.g., tons) of surplus emission reductions that have already occurred and can be clearly demonstrated.

2. Buyer Beware. Regulators need to focus their attention on the elements of emission transactions that affect the public interest, rather than attempting to oversee all aspects of trading. Thus state trading regulations should place the burden on users to demonstrate that SDRs proffered to create credits are supported by actual surplus emissions reductions that have already occurred elsewhere, not require permit and/or SIP revisions from all parties to a transaction.

3. Use of SDRs as a Compliance Option. In line with the new conception of transactions in discrete units, regulators need to conceive of SDRs as compliance "software," an alternative to installing pollution control hardware. Transactions in which sources exchange emission limits perpetually are appropriately dealt with as SIP revisions; transactions in SDRs, which represent discrete, completed pollution control actions, do not alter the underlying obligations of the SIP and should not require SIP revisions.

4. Workable Banking. States should provide for meaningful banking systems that will allow those in the market to create an inventory of SDR products for sale to those who need credits for compliance purposes. "Banks" where deposited SDRs depreciate too rapidly will not serve this function.

5. Eliminating Variances. Regulators need to recognize that a market in SDRs provides them an alternative to variances, "alternative emission limitations," and the like that provides flexibility to regulated entities and protects the public interest in cleaner air.

6. Interstate Transactions. Regulators should consider the potential economic benefits, particularly in the Northeast, of encouraging environmentally sound interstate emission transactions. The ability to oversee interstate transactions through the "long-arm" mechanism of the open market system means that states can obtain the economic benefits of letting sources of emissions with high compliance costs in, e.g., New England, discharge their ozone emission reduction obligations by engaging in transactions with sources that have low compliance costs in upwind states. State regulations should focus on uniform procedures applicable to in-state sources seeking recognition of SDRs as credits, without regard to state of origin.

Conclusion

For some time what this paper has called closed market systems have been acknowledged as a workable, effective way to capture the economic and environmental benefits of emission trading. With respect to the pervasive ozone smog problems of our major metropolitan areas, however, a market-based instrument capable of obtaining these benefits with ample assurance of enforceability has remained elusive. This article presents an alternative, the incrementally created open market system, that can provide both the benefits and the assurances needed, and in the process may lay the groundwork for an eventual closed market system to control smog. As state and federal policy-makers grapple with the Clean Air Act's mandate to adopt programs that will achieve

healthful air quality for all Americans, they would be wise to consider the value of the open market system presented here.

Footnotes

¹ As noted in EPA's Economic Incentive Program Rules,

"The [Clean Air] Act, as amended in 1990, broadly encourages the use of incentive-based approaches to control air pollution" 59 FR 16690 (April 7, 1994). The amendments establish a federally managed trading system for power plant pollutants, and encourages their use in state implementation plans for ozone, PM10, and carbon monoxide.

² Some have suggested other reasons. Market-based programs may be more attractive to businesses because they offer regulated entities a greater sense of freedom and control over their own destiny. Others suggest that the use of market terms makes the pollution control enterprise more cognizable to those practiced in the business world.

³ 44 FR 71779 (Dec. 11, 1979). The bubble rules were modified by a proposed emissions trading policy statement issued as "interim guidance," 47 FR 15076 (April 7, 1982), which was further supplemented by a request for further comment 48 FR 39580 (Aug. 31, 1983). This statement was later replaced with a more comprehensive Emission Trading Policy Statement, 51 FR 43814 (Dec. 4, 1986).

⁴ 49 FR 50766 (Oct. 14, 1984). EPA's "netting" policy was affirmed in *Chevron U.S.A. Inc. v. Natural Resources Defense Council*, 104 S.Ct. 2778, 21 ERC 1049 (1984).

⁵ EPA's policies with respect to trading in general were set forth in "Emissions Trading Policy Statement," *supra* at n. 3. This statement has been supplemented, and to some extent superseded, by "Economic Incentive Program Rules," issued in April 1994. 59 FR 16690 (April 7, 1994).

⁶ Clean Air Act as amended in 1990, Title IV, 42 USC Sections 7651 to 7651o.

⁷ South Coast Air Quality Management District "Regional Clean Air Incentive Market (RECLAIM)," Rule 2000-2012, 2015 (1993).

⁸ 310 Code of Massachusetts Regulations 7.00, Appendix B.

⁹ Illinois EPA, "Draft Proposal: Design for VOM Emissions Trading System." (October 1994).

¹⁰ EPA's EIP regulations define "surplus" emissions as "emission reductions in excess of an established program baseline which are not required by SIP requirements or State regulations, relied upon in any applicable attainment plan or demonstration, or credited in any RFP or milestone demonstration. . . ." 51 CFR 51.491.

¹¹ In theory, SDRs may be created by surplus emission reductions from stationary sources, mobile sources, by reformulating products, or even by shutting down the facility. Use of shutdowns has been highly controversial in the past, however, because of regulators' concerns that in many cases the lost production is simply shifted to other facilities, in effect relocating, rather than eliminating, the emissions. The EPA Economic Incentive Program regulations permit limited use of shutdowns to create emission credits, if the state has not taken credit for the reduced emissions already as part of its strategy to attain the federal air quality standards, and if the shutdown results in real decreases in the area's aggregate emissions. The EPA policy does not address the handling of shutdowns where emissions are transferred to other facilities outside the same "area." See EPA EIP rules, 59 FR 16690, 16698-99 (April 7, 1994).

¹² A buyer and seller may transact for a continuing "stream" of SDRs, but the transaction will differ fundamentally from such transactions under current practice. In an open market, as under the acid rain program, a contract for sale of a stream of SDRs will bind the seller to create an agreed upon number of tons of surplus emission reductions each year for the period covered in the contract. By contrast, under most current policies, the parties would agree to a state-sanctioned change in their applicable emission limitations.

¹³ In previous pronouncements on emission trading, EPA has stated that emission reductions must be "permanent" to be used in an emission transaction. In the Economic Incentive Program regulations, the agency has made clear that the term "permanent" allows for the creation of credits through discrete emission reductions: "Such reductions can be discrete or continuous, depending on the nature of the program. Discrete (i.e., temporary) reductions can be used to defer but not solely to satisfy the continuous emission

reduction requirements (e.g., BACT)." EIP regulations, 59 FR 16690, 16691 (April 7, 1994). While the term "temporary" subtracts from the clarity of this pronouncement, it seems apparent that a system built on transactions in discrete emission reductions (e.g., in tons) is acceptable under the EIP.

"Banking" of SDRs is a crucial element of an open market system, as will become apparent below. EPA is currently considering further guidance on banking in the context of Economic Incentive Programs. EIP regulations, 59 FR 16690, 16691 (April 7, 1994).

"State regulations might, for example, provide for different treatment depending on whether SDRs were created during the ozone and non-ozone season, whether they are upwind or downwind of the user source, etc. See discussion, *infra*.

"EPA's EIP regulations encourage states to adopt programs that will capture a portion of the benefits of trading to improve air quality. For example, when adopting economic incentive programs applicable to sources subject to RACT requirements, states are encouraged to impose tighter aggregate emission limitations on categories of sources permitted to engage in emission trading transactions. EIP regulations, 59 FR 16690, 16696 (April 7, 1994).

"The regulations are cited at n. 3 and 4, *supra*.

"EPA Emissions Trading Technical Issues Document, 51 FR 43837, 43842 (Dec. 4, 1986). Under this policy, a "compliance instrument" may take the form of "an agreement between the source and state, a preconstruction permit, ..., a consent decree, a state operating permit, or any other compliance instrument judicially enforceable by the state." It "generally requires source-specific emission limits," including "applicable restrictions on hours of operation, production rates or input rates; enforceable test methods for determining compliance; and necessary recordkeeping or reporting requirements." *Id.* at 43843-4.

"See *Id.*, at 43825 and 43848.

"That is, the function relating pollution levels in the atmosphere to health or other effects of concern. For acid rain, the National Academy of Sciences provided the damage function, which, while controversial, was accepted as adequate by policy-makers. Thus it was possible for policy-makers to identify an acceptable emission goal that would determine the amount of "currency" in the system.

"In the case of the acid rain control program, the relatively small number of major sources and the quantities of emissions of SO_x were relatively well known.

"When fully implemented, the RECLAIM program will achieve reductions of about 75 tons per day of NO_x during the ozone season. By contrast, open market systems that were implemented voluntarily, without government sanction, during the summer of 1993 achieved NO_x reductions of 30 tons per day, along with 6 tons per day of volatile organic compounds, which also contribute to ozone formation.

"Some closed market proposals have addressed this problem by explicitly limiting the time of the entitlement, for example, by issuing allowances on an annual or periodic basis, rather than on a perpetual basis. And some contemplate issuing a regularly shrinking

quantity of allowances in order to meet the Clean Air Act's requirements for regular emission reductions.

"Many economists would argue that the ideal economic incentive program would use pollution taxes or fees to internalize the costs of pollution damages into economic decision-making.

"As stated in EPA's Economic Incentive Program regulations, "Thus the final rules and guidance establish as a goal for all EIP's that they be designed to benefit both the environment and the regulated entities. In so doing, the final rules and guidance require States to meet this benefits sharing goal, while providing flexibility to the States to determine how best to do so." Preamble to the EIP regulations, 59 FR 16690, 16702 (April 7, 1994).

"Under the Clean Air Act, the federal government establishes "National Ambient Air Quality Standards," which, "allowing an adequate margin of safety, are requisite to protect the public health." Clean Air Act, Section 109(b)(1).

"For example, the records of the current EPA proceeding reviewing the OTC's low emission vehicle (LEV) petition and of the OTC's current proceeding considering additional regional reductions in NO_x emissions are filled with evidence showing a generally southwest-to-northeast airflow along the Eastern Seaboard and consideration of policies appropriate to this scientific paradigm.

Recently the OTC announced a Memorandum of Understanding in which Northeastern state air regulators agreed to a regional NO_x reduction strategy which included no limitations on the direction of emission trades along the eastern seaboard. The regulators supported this position with a study done by Tech Environmental Inc., which rejected directional limitations on trading on the grounds that "all NO_x sources in the OTR appear to contribute to high measured ozone levels during episodes." Tech Environmental, "Feasibility of a Regional Market-based NO_x Budget System for the Ozone Transport Region," (October 1994).

"Auto manufacturers have argued that the California LEV program, which has been recommended by the Ozone Transport Commission for adoption in the Northeast, is an economically inefficient means of achieving reductions in nitrogen oxides. If the LEV requirement were adopted, but manufacturers were permitted to comply with it either by sales of LEVs or by purchases of SDRs from sources such as these utility units, it might substantially lower the cost of achieving the region's overall emission reduction goals.

"The EPA EIP regulations, *supra* n. 1, consider additional issues raised by economic incentive programs.

"EPA's discussion applied to "discretionary" EIPs: i.e., EIPs adopted by states for non-attainment areas that are not required to have EIPs under the Clean Air Act. The act requires EIPs in areas that fail to achieve required emission reductions. CAA, Sections 182(g)(3), 182(g)(5), 187(d)(3), and 187(g).

"But see n. 26, *supra*.

"Areas designated "serious," "severe," or "extreme" non-attainment for ozone must make such demonstrations. (Section 182(c)(2)(B)). EPA's EIP regulations require that economic incentive programs be "consistent with the timely attainment of NAAQS [National Ambient Air Quality Standards], all applicable RFP and visibility requirements. ..." 41 CFR 51.493.