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Where Did All the Markets Go? An Analysis of EPA’s Emissions Trading Program

Robert W. Hahn†
Gordon L. Hester‡‡

Since its creation in 1970, the Environmental Protection Agency (EPA) has promulgated an array of “command and control” regulations that specify the methods and technologies firms must use to control pollution. Recognizing that this regulatory approach is often unduly expensive, EPA began in 1974 to experiment with alternatives that allow firms greater flexibility in meeting national air quality goals. Since then, the Agency has developed and implemented an ambitious policy—emissions trading—that allows firms to trade rights to emit air pollutants. According to EPA administrator Lee Thomas, emissions trading has become “one of EPA’s most impressive accomplishments.”

In spite of the potential importance of emissions trading as an alternative to conventional regulatory approaches, surprisingly little effort has been spent evaluating the impact of this program. This Article is the first attempt to provide a systematic analysis of the different elements that constitute emissions trading. Our analysis shows that the bulk of emissions trading has taken place in activities different from those predicted by researchers and regulatory analysts.

This Article begins with a review of past research concerning the use of market systems to regulate activities that adversely affect the environment. Part II summarizes the legislative and regulatory underpinnings of emission trading. Part III discusses the four different activities of emissions trading: offsets, bubbles, banking, and netting. Part IV describes the role of the federal government in the development of emissions trading.

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1. Emissions trading consists of four different activities: emissions offsets [hereinafter offsets], bubbles, banking of emission reduction credits [hereinafter banking], and netting. Emission Trading Policy Statement, General Principles for Creation, Banking and Use of Emission Reduction Credits, Final Policy, 51 Fed. Reg. 43,814, 43,830 (1986) [hereinafter Final Trading Policy]. See infra notes 59-77 and accompanying text (discussion of offsets); see infra notes 78-105 and accompanying text (discussion of bubbles); see infra notes 106-24 and accompanying text (discussion of banking); see infra notes 125-44 and accompanying text (discussion of netting).

tions trading and the four major activities allowed under the program. Part III examines the performance of these activities and demonstrates that although the economic gains from the program have been substantial, they have fallen far short of their potential. This examination also suggests that environmental quality appears to be largely unaffected by the use of emissions trading.

The presentation of data on the performance of emissions trading, although important, does not in itself provide a basis for understanding the reasons for that performance. Part IV describes how the structure of the federal and state regulatory systems limits the ability of firms to use emissions trading effectively. Part V evaluates several proposals to reform emissions trading, including EPA's "final" emissions trading policy. This Article concludes with an assessment of the potential scope for regulatory reform in light of regulatory and political constraints.

I. The Design and Potential of Market-Based Pollution Control Programs

For many years, economists and lawyers have argued that the command and control approach to environmental regulation is inefficient and that other approaches can, in principle, achieve any desired level of environmental quality at a lower cost. To support this argument, economists have conducted numerous theoretical studies and created a number of simulation models that compare existing regulatory approaches with market-based systems. The simulation models reveal that a more judicious design of regulatory approaches for emissions control could result in savings amounting to billions of dollars. This potential for savings motivates the development of marketable permit systems such as emissions trading.

Initial theoretical research focused on the design of efficient markets to control externalities. This research demonstrated that by creating markets

4. For a detailed review of these studies, see Hahn, Literature Review For Tradable Permits in Implementing Tradable Emissions Permits for Sulfur Oxides Emissions: A Case Study in the South Coast Air Basin (California Institute of Technology ARB Contract No. A8-141-32, 1982).
5. Three basic steps are necessary to design a market system to limit pollution: (1) define the commodity that is being traded, such as permits to emit pollutants; (2) distribute the permits; and (3) design rules for trading them. The government can control the aggregate level of emissions by fixing the overall number of permits, and suitable trading rules can give firms flexibility to meet their objectives in a manner consistent with broader societal environmental objectives. For a detailed discussion of some of the basic issues involved in implementing market systems, see Hahn, Marketable Permits: What's All the Fuss About?, 2 J. Pub. Pol'y 395, 395-411 (1982).
6. J. Dales, Pollution, Property and Prices (1972); Montgomery, Markets in Licenses and Efficient Pollution Control Programs, 5 J. Econ. Theory 395, 395-418. For a comprehensive review of the theory, see W. Baumol & W. Oates, The Theory of Environmental Policy.
in pollution rights, the government could achieve any specific level of environmental quality at the lowest possible aggregate cost. Recent research, however, has questioned some of the critical assumptions underlying these results. One of these assumptions is that firms are price-takers in a competitive permit market. Hahn provides a formal analysis of this issue and shows how the efficiency of the market can be affected by simple changes in the allocation of permits to firms.\(^7\) A second assumption is that maximum efficiency is obtained through the development of several markets. Because organizing a large number of markets may be impractical, examining this assumption is important.\(^8\) A third assumption relates to monitoring and enforcement problems that are not explicitly addressed in the early analyses. More recent studies indicate that these issues play a critical role in the efficient design of regulatory approaches for addressing environmental problems.\(^9\)

In a survey of studies estimating the potential cost savings available from a tradable permit system, Tietenberg reviewed the short-run cost savings available in moving from a command and control system to a market system.\(^10\) In several cases, the command and control system costs more than twice the theoretical ideal to achieve a prescribed environmental target. Given that EPA projects that total air emissions control costs in the United States will exceed $175 billion for the period 1981 to 1990, the potential cost savings from implementing a system of tradable emission permits are very large.\(^11\) Tietenberg noted, however, that these studies typically assumed that none of the capital equipment necessary for emissions control is yet in place when, in fact, emissions trading was introduced after sizable capital expenditures for control equipment had already been made.\(^12\) Nevertheless, emissions trading could, in our opinion, save billions of dollars annually.\(^13\)

\(^11\) See ENVTL. PROTECTION AGENCY, FINAL REPORT: THE COST OF CLEAN AIR AND WATER 12 (Report to Cong. 1984) (cost estimate reported is for stationary sources of emissions only).
\(^12\) T. TIETENBERG, supra note 10, at 48-49.
\(^13\) See infra notes 98-100, 132-40 and accompanying text (analysis of potential savings from emissions trading).
Research directly addressing the implementation of emissions trading is in its infancy. Hahn and Noll addressed some of the key factors to consider when determining whether a competitive market in emission permits can be established; however, as they note, the system they propose constitutes a more radical institutional change than the existing emissions trading policy.\footnote{Hahn & Noll, Designing a Market for Tradable Emissions Permits, in Reform of Environmental Regulation 119–46 (W. Magat ed. 1982).} Ackerman and Stewart also propose a fundamental restructuring of emissions control regulations; they advocate incorporating auctions to distribute emission permits and abandoning the strategy of setting uniform air quality standards.\footnote{Ackerman & Stewart, supra note 3, at 1351–65.} While these proposals are innovative, we believe their wholesale adoption is unlikely to occur in the near future.\footnote{See infra notes 162–70 and accompanying text (discussion why amendment to existing emissions trading program unlikely).}

Few studies have attempted to quantify the actual performance of emissions trading, partly because of a lack of available data.\footnote{As a consequence of a division of responsibilities between EPA and the states, no single entity has taken the initiative to collect data on the performance of emissions trading activity. EPA has collected data on the "bubbles" it has approved, but information on emissions trading activities that are controlled primarily at the state level is contained in thousands of individual permit files. This is significant because most emissions trading activity has occurred in programs over which the states have primary jurisdiction.} An early analysis by Vivian and Hall\footnote{W. Vivian & W. Hall, An Examination of U.S. Market Trading in Air Pollution Offsets (1981) (Univ. of Mich., Inst. of Pub. Pol'y Stud.) (on file with authors). See infra notes 59–77 and accompanying text (discussion of offset program).} attempted to study markets in offsets,\footnote{Envtl. Protection Agency, Office of Policy Analysis, The Emissions Trading Policy in the United States of America: An Evaluation of its Advantages and Disadvantages and Analysis of its Applicability in the Federal Republic of Germany (1984) (on file with authors).} but they found that too few offsets had been traded between firms to conclude that any market in fact existed. Rehbinder and Sprenger provided a detailed description of the emissions trading policy and summarized the information on program performance that had been gathered by EPA through 1982.\footnote{John Palmisano, Emissions Trading Reforms: Successes and Failures (paper presented at Air Pollution Control Ass'n Ann. Meeting, 1985) (on file with authors); John Palmisano, An Evaluation of Emissions Trading (paper presented at Air Pollution Control Ass'n Ann. Meeting, 1983) (on file with authors); John Palmisano, Have Programs for Trading Emission Reduction Credits Failed or Succeeded? (paper presented at Air Pollution Control Ass'n Ann. Meeting, 1982) (on file with authors).} However, they did not address the program's theoretical underpinnings and did not make a comprehensive evaluation of its success due to a lack of performance data.

Early statements about program performance were generally written by people inside the Agency who were directly involved in the program. The general theme emerging from this literature is that the emissions trading policy is an exciting regulatory reform with great potential.\footnote{18. W. Vivian & W. Hall, An Examination of U.S. Market Trading in Air Pollution Offsets (1981) (Univ. of Mich., Inst. of Pub. Pol'y Stud.) (on file with authors). See infra notes 59–77 and accompanying text (discussion of offset program).} In the only
previous comprehensive analysis of the emissions trading policy, Liroff described emissions trading and its evolution and provided information on some of the early activities under the policy. In a later book, he analyzed the implementation of bubbles and described other aspects of emissions trading. This study focused primarily on environmental quality issues, although it did describe some of the cost savings resulting from bubble use. It concluded that emissions trading had little impact on environmental quality, but that emissions trading regulations should be more restrictive to lessen the potential for abuse in the future.

Several important conclusions emerge from a review of this literature. First, the use of marketable permits appears, at least in theory, to promote more cost-effective regulation of air pollutants than do command and control regulations. Second, the potential cost savings from the adoption of a pure system of marketable air emission permits are quite large. Third, the theoretical systems advocated by economists differ in important ways from the existing emissions trading policy. While studies of the implementation of emissions trading have often acknowledged these differences, they have never been analyzed in detail. Thus, only an incomplete picture of the actual performance of the emissions trading policy exists.

II. Clean Air Act Regulations and Emissions Trading

EPA's emissions trading program extends, rather than replaces, the system for regulating emissions of air pollutants established under the authority of the Clean Air Act. Emissions trading allows the exchange of emission rights both externally (between firms) and internally (within a single firm). The commodities exchanged in emissions trading are emission reduction credits (ERCs), which are property rights to emit air pollutants. A firm creates ERCs by reducing its emissions of a specific pollutant below the baseline level allowed by its permit, thereby creating

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24. R. LIROFF, supra note 23, at 135-44.
26. An emission reduction credit is the unit of currency in emissions trading. Credits are denominated in tons per year of specified pollutants. Firms can earn these credits by controlling pollution at a specific source beyond the level required by regulation. The credits are used in bubbles, offsets, and netting. Final Trading Policy, 51 Fed. Reg. 43,814, 43,831 (1986).
28. The “baseline” level of emissions refers to the level of emissions from which ERCs are calcu-
surplus reductions. EPA regulations specify that these reductions must be surplus, enforceable, permanent, and quantifiable in order to qualify as ERCs.29

A. Regulation of Air Pollutant Emissions

An understanding of the system for regulating air emissions is a prerequisite for understanding emissions trading. Those elements of the system that affect emissions trading are described in this section.30 The Clean Air Act assigns responsibility for setting air quality standards to EPA31 and responsibility for their implementation to the states.32 EPA has established two types of standards: ambient and emission. Ambient standards set maximum allowable concentrations for selected air pollutants.33 Responsibility for meeting these standards rests primarily with those states located within each air quality control region.34 The country is divided into 247 air quality control regions;35 those that exceeded ambient air quality standards when they were formed are called “attainment areas,”36 and those that did not are called “nonattainment areas.”37

To ensure that each region meets its ambient standards, states must develop State Implementation Plans (SIPs), which in turn must be approved by EPA.38 SIPs are blueprints that detail how states plan to meet or maintain ambient air quality standards by showing which sources of pollution will be regulated, how they will be regulated, and how proposed regulations will affect emissions and air quality.

Emission standards state the amount of a given pollutant that a particu-
lar type of source may emit. In general, emission standards for existing sources are less stringent than those for new sources, and those for sources in attainment areas are less stringent than those for sources in nonattainment areas. States implement EPA's emission standards through permit systems described in the SIPs. Sources are categorized either as "major sources," which always require permits or as "minor sources," whose permit requirements vary by state. Permits specify emission limits set in accordance with EPA standards.

States have encountered two significant problems in their attempts to satisfy EPA standards established under the Clean Air Act. First, most states did not have sufficient time or resources to acquire the information necessary to design successful implementation plans. In particular, emission inventories were either incomplete or inaccurate in many states. Second, in many cases, the emission limits set in individual source permits were not sufficiently stringent to enable states to attain ambient air quality standards. For example, numerous regions have yet to achieve attainment for ozone.

41. EPA regulations specify that a source must be considered major for a pollutant if it emits more than 250 tons per year of the pollutant or, in the case of a source that falls into one of 27 industrial categories identified by EPA as important sources of air pollution, if it emits more than 100 tons per year. 40 C.F.R. § 51.165(iv)(A)(1) (1987). Sources that produce emissions below these thresholds are designated as minor sources. However, states are allowed to set lower thresholds for distinguishing major and minor sources, and many have done so. 42 U.S.C. § 7416 (1982).
42. EPA standards are binding on the states in the sense that they set maximum allowable amounts of pollutants from specified types of sources. States can always set limits more stringent than EPA standards if they wish to do so. 42 U.S.C. § 7416 (1982).
43. R. LIROFF, supra note 23, at 21-22.
44. While no study focuses on the quality of states' emission inventories, several note significant deficiencies in those inventories. See, e.g., Roberts & Farrell, The Political Economy of Implementation: The Clean Air Act and Stationary Sources in Approaches to Controlling Air Pollution 156-57 (A. Friedlander ed. 1978); Nat'l Comm'n on Air Quality, To Breathe Clean Air 3.2-17 to 3.2-21 (1981) [hereinafter Nat'l Comm'n]; Dames & Moore, An Investigation of Prevention of Significant Deterioration (PSD) and Emission Offset Permitting Processes, 4-62 to 4-70 (1980) [hereinafter Dames & Moore] [prepared for Nat'l Comm'n on Air Quality] (discussion of inconsistencies between assumptions about operating conditions used in compiling emission inventories and actual operating conditions); S. Connolly, H. Schwartz, E. Shapiro & G. Vogel, Emissions Trading in Selected EPA Regions 11-17, 29 (Jellinek, Schwartz, Connolly & Freshman, Inc. Report, 1984) [hereinafter S. Connolly] (EPA-commissioned study of emissions trading noting difficulties in calculating emissions from individual sources and criticizing quality of information included in emission inventories); R. LIROFF, supra note 23, at 10-11; Levin, supra note 21, at 65.
B. Baselines and Property Rights in Emissions Trading

The fact that established permit limits have often not enabled states to meet air quality goals has been a major source of the controversy surrounding emissions trading. Opponents of emissions trading argue that, as long as further reductions in emissions are needed to improve air quality, surplus rights should not be traded. Its proponents argue that the economic gains available through emissions trading should not be sacrificed because of the inadequacies of the permit system.47 This controversy has led to uncertainty about the nature and value of a firm's property rights. Consequently, it has had a significant effect on the use of emissions trading as a means for firms to increase the cost-effectiveness of air pollution control.

Calculating the amount of surplus emission reductions that a firm is entitled to use in emissions trading is, in theory, simply a matter of comparing the applicable baseline quantity of emissions to the firm's actual emissions. Yet, in practice, this is often a difficult task due either to ambiguity about the baseline or to lack of data on emissions or both. Most states use the amount of emissions allowed in a firm's permits as the baseline.48 However, at least twenty states employ baselines that either explicitly consider a firm's actual historical emissions or vary according to the emissions trading activity the firm uses.49 Baselines that consider historical emissions can also be ambiguous to the extent that a firm is uncertain about how regulators will calculate historical emissions.

Even if the baseline for determining a firm's surplus reductions is clear, determining a firm's current level of emissions might not be. Current emission levels are typically calculated rather than measured directly.50 Because these calculations are subject to the approval of regulators who must approve an emissions trade, a firm is often unable to know how a regulator will calculate its actual emissions.51

When baselines and reductions from baselines are ambiguous or difficult to calculate, firms are uncertain about the amount of surplus reduc-

46. See infra notes 54–57 and accompanying text.
48. See supra note 28.
49. Env'tl. Law Inst., Collection of State Emissions Trading Rules (1984) [hereinafter ELI] (on file with authors). 22 states use baseline emissions as allowable emissions, 8 states use the lower of allowable or actual emissions, 8 states use variable baselines (for example, different baselines for offsets and bubbles), 4 states use actual emissions, and no information was given for 8 states.
50. Id.
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tions to which they are entitled. Obtaining the information necessary to
resolve this uncertainty involves costs, and a firm may perceive that there
is an additional cost in drawing the attention of regulators to its pollution-
control activities. Thus, the lack of clearly quantified property rights cre-
ates a disincentive for firms to create surplus emissions reductions and to
participate in emissions trading.

Even if a firm’s property rights in surplus emission reductions can be
calculated accurately at any given time, the potential for regulatory
change can create uncertainty regarding the quantity of reductions that
can be used for future emissions trades. New emissions control require-
ments that lower the amount of a firm’s allowable emissions may be
imposed. Reductions that were once surplus would then be required,
thereby effectively confiscating the property right held by the firm.53 Uncer-
tainty about the durability of these property rights creates an addi-
tional disincentive for firms to engage in emissions trading.

In addition to being a source of uncertainty, the inadequacy of state
regulators’ baseline calculations is a source of controversy in emissions
trading. Many state emission inventories are based on unrealistically high
calculations of emission sources, so that the allowable emission rates speci-
fied for sources significantly exceed actual rates.54 As a result, a firm
might receive credit for surplus emission reductions without reducing
actual emissions. Opponents of emissions trading have strongly criticized
this aspect of emissions trading, which they argue creates only paper cred-
its.55 However, it is important to note that the use of paper credits is not a
problem created by emissions trading per se, but rather by poor state
implementation of the Clean Air Act. If emission inventories were sub-
stantially improved to reflect actual emissions, the problem of paper cred-
its could be eliminated.

Another basis of criticism of emissions trading is the use of surplus
reductions created when firms shut down sources, rather than through the
application of emissions control technologies. Environmentalists have
argued that the use of “shutdown credits” should not be allowed, espe-
cially in nonattainment areas, because their use in bubbles allows firms to

53. A 1980 EPA publication stated that:

[A]n ERC cannot be an absolute property right. If a community falls behind in its efforts [to
achieve air quality standards] . . . it must have the option of modifying its use of ERCs. In
developing banking rules, states must articulate the options they may use to correct this poten-
tial problem such as discounting a firm’s ERCs based on the average reduction required or
establishing a moratorium on the use or creation of ERCs.

ENVTL. PROTECTION AGENCY, EMISSIONS REDUCTION BANKING AND TRADING UPDATE 2 (Oct.
1980) (emphasis in original).

54. DAMES & MOORE, supra note 44, at 4-48, 4-53, 4-59, 4-70.

55. R. LIROFF, supra note 23, at 12, 15.
avoid their obligations to install emissions control equipment.\textsuperscript{56} Yet, if state emission inventories were accurate, air quality goals should be met through reductions required in SIPs, and emission reductions from shutdowns could be used in emissions trading without compromising environmental quality goals. Thus, the problem with shutdown credits, as with paper credits, is not inherent in emissions trading, but is a result of state implementation of the Clean Air Act. However, at present, the controversy over the use of these shutdown credits is a disincentive for firms that might otherwise have used these credits to engage in emissions trading. Ironically, this may have an adverse effect on environmental quality to the extent that it induces firms to continue to operate older plants with less efficient emissions control equipment rather than replace them with new plants that feature newer, more efficient equipment for controlling emissions.\textsuperscript{57}

III. The Performance of Emissions Trading

Although not all the detailed information on cost savings and environmental quality impacts that would be useful is available,\textsuperscript{58} the analysis presented in this Part contributes to the understanding of the performance of emissions trading. Specifically, the data compiled below provide estimates of the relative frequency with which firms use the various emissions trading activities. The data have also enabled us to identify certain characteristics of firms using emissions trading, some of the incentives (and disincentives) that exist for firms to trade ERCs, and the markets in which emissions trading takes place.

Emissions trading involves four different activities that firms may utilize: offsets, bubbles, banking, and netting. These activities are introduced below and discussed at length in the sections that follow.

- Offsets are used when a major new emission source seeks to locate in a nonattainment area. The new emissions may be offset with emission reductions of an equal or greater amount. The required credits may be obtained through internal or external trades.

- A bubble enables a firm to treat an existing plant with multiple emission sources as if it were a single source. Derived from the concept of a bubble enclosing an entire facility with emissions escaping through a single opening, a bubble allows a firm to adjust the mix of controls on

\textsuperscript{56} Id. at 16.
\textsuperscript{57} Id. at 89–91.
\textsuperscript{58} See supra note 17.
individual sources to meet the total emission limit for the facility in a more cost-effective manner.

- Banking enables a firm to hold ERCs as assets for future use or sale. Each state regulatory agency must develop its own administrative procedures in order to have a banking program. Details of these programs differ significantly across states.

- By using netting, a firm seeking to increase emissions at one source in a plant can avoid classification as a major source by reducing emissions elsewhere within its facility. The reduction in emissions must be enough so that the net increase in emissions is below the level at which a new source would be considered a major source. Since the reduction used for netting need not be as great as the emissions increase that will be caused by the modification, a netting transaction can result in a small increase in emission levels.

A.Offsets

EPA's offset program permits the construction of major new emission sources in nonattainment areas by allowing firms to offset emissions increases from these sources with decreases in the same type of emissions from these new sources. If the offset program had not been established, many nonattainment areas would have faced a ban on construction of major and modified emission sources beginning in 1979. Offsets are a unique element of emissions trading because they are mandatory for major new sources in nonattainment areas.

Despite EPA's lack of comprehensive data on offset transactions, which are regulated by the states, the Agency's data can be used to estimate offset activity. Approximately 1500 sources used offsets between 1977 and 1980, while approximately 500 sources used offsets between 1981 and 1986. The proportion of these offset transactions that involve internal

59. The emissions decrease must be more than equivalent to the increase to assure there will be progress towards achievement of the air quality standards. Emission Offset Interpretive Ruling, 44 Fed. Reg. 3274, 3274-76 (1979) (to be codified at 40 C.F.R. pt. 51).

60. Subsequent amendments to the Clean Air Act extended the deadlines for achieving attainment to 1982 and, for some pollutants, to 1987. EPA is not required to impose construction bans in areas not reaching attainment until after the expiration of these deadlines. 42 U.S.C. § 7410(a)(2)(I) (1982).

61. An exception to this occurs when a SIP provides for emission reductions greater than those necessary to meet ambient air quality standards. In these cases, the state may allow new emission sources in an area without requiring offsets.

62. The estimate for 1977 through 1980 is based on the assumption that about the same number of major source permits have been issued since 1977 in nonattainment areas as in areas that have never been classified nonattainment. This is a conservative assumption given the fact that nearly all industrial centers are in nonattainment areas. The latter areas are called "Prevention of Significant Deterioration" (PSD) areas. ENVTL. PROTECTION AGENCY, ANALYSIS OF NEW SOURCE REVIEW
and external trades is not clear. However, a 1981 study commissioned by the National Commission on Air Quality found a "pattern of offsets derived from company-owned sources." External trades apparently account for only a small proportion of offsets.

Although in many areas offsets have had limited use, a significant number of external offset transactions have occurred in the South Coast Air Quality Management District (SCAQMD), which is located within the Los Angeles basin area. Three factors explain the higher number of offset transactions in this area. First, firms have had to obtain offsets in order to accommodate the strong industrial growth the area experienced over the last decade. Second, difficulties in meeting air quality goals in the area led regulators to set the threshold level at which new sources are classified as major far below the minimum specified by EPA. Third, regulators have set standards for existing sources at stringent levels, making it difficult for firms to use netting in place of offsets.

(NSR) PERMITTING EXPERIENCE I (Aug. 1982) [hereinafter PERMITTING EXPERIENCE]. 1100 major source permits were issued, most frequently in PSD areas or in combination PSD/nonattainment areas, during the period from 1978 through 1980. Because EPA did not establish its offset policy until December 1976, it is reasonable to assume that no offsets were used in 1976. Air Quality Standards, Interpretive Ruling, 41 Fed. Reg. 55,524 (1976) (to be codified at 40 C.F.R. pt. 51); Review of New Sources and Modifications: Preparation, Adoption, and Submittal of Implementation Plans, Requirements, 41 Fed. Reg. 55,558 (1976) (to be codified at 40 C.F.R. pt. 51) (proposed Dec. 15, 1976). If offset activity were at a similar level in 1977 as in the period from 1978 to 1980, then about 400 offset transactions would have occurred that year. This makes a total of 1500 in the first 4 years of the program. The estimate that 500 sources have used offsets between 1981 and 1986 is based on data from nonattainment areas. A regulatory change in 1980 sharply reduced the number of sources considered major for permitting purposes. Requirements for Preparation, Adoption, and Submittal of Implementation Plans, Approval and Promulgation of Implementation Plans, 45 Fed. Reg. 52,676, 52,693-98 (1980) (to be codified at 40 C.F.R. pts. 51, 52, 124). In 1984, only 57 major new sources or modifications received permits in nonattainment areas. ENVTL. PROTECTION AGENCY, NATIONAL AIR AUDIT SYSTEM GUIDANCE MANUAL FOR FISCAL YEAR 1985 (Office of Air Quality Planning and Standards No. EPA-450/2-84-008, 1985) [hereinafter 1984 NATIONAL AIR AUDIT DATA] (on file with the authors). Assuming that about 80 offset transactions per year occurred after 1980, there would have been approximately 500 transactions from 1981 through 1986, resulting in a total of 2000 transactions.

63. DAMES & MOORE, supra note 44, at 4-72. Interview with John Palmisano, President, AER*X Corp. (July 8, 1986); Interview with Leslie Ritts, Former Staff Member, Environmental Law Institute (July 10, 1986) [hereinafter Ritts interview]; Interview with Barry Elman, Staff Member, EPA Regulatory Reform Staff (July 13, 1986).

64. Interview with John Palmisano, President, AER*X Corp. (Dec. 10, 1985) [hereinafter Palmisano interview].

65. The SCAQMD is a local regulatory agency. Several similar local agencies exist across the country, and our references to state regulatory agencies should be construed to include this type of agency.

66. The SCAQMD is a nonattainment area because it failed to meet EPA ambient air quality standards. See supra notes 59-61 and accompanying text (discussion of why firms in nonattainment areas must use offsets).

67. The emission level at which a source is classified as major is only 20 tons per year, compared to 100 or 250 tons in the EPA standard. 1984 NATIONAL AIR AUDIT DATA, supra note 62.

68. Palmisano interview, supra note 64. See infra notes 128-41 and accompanying text (discussion of why firms would desire to use netting rather than offsets).
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Table 1 presents a history of external trades for volatile organic compound offsets in the SCAQMD from 1983 to 1985.

Table 1

External Offset Transactions For VOC
South Coast Air Quality Management District, 1983-1985

<table>
<thead>
<tr>
<th>Year</th>
<th>Number of Trades</th>
<th>Mean Size In Tons Per Year</th>
<th>Mean Price Per Ton</th>
<th>Price Range Per Ton</th>
</tr>
</thead>
<tbody>
<tr>
<td>1983</td>
<td>3</td>
<td>16</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>1984</td>
<td>5</td>
<td>27</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>1985</td>
<td>42</td>
<td>51</td>
<td>$2500</td>
<td>$850 to $3250</td>
</tr>
</tbody>
</table>

NA = Not Available

Table 2 presents information on external trades in 1985 for all pollutants.

Table 2

External Offset Transactions For All Pollutants
South Coast Air Quality Management District, 1985

<table>
<thead>
<tr>
<th>Pollutant</th>
<th>Number of Trades</th>
<th>Total Volume Traded</th>
<th>% of Total Emissions</th>
<th>Mean Price*</th>
<th>Price Range**</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nitrogen Oxides</td>
<td>5</td>
<td>575</td>
<td>&lt;0.5</td>
<td>$5000</td>
<td>$2000 to 5500</td>
</tr>
<tr>
<td>Carbon Monoxide</td>
<td>3</td>
<td>27</td>
<td>&lt;0.1</td>
<td>$3000</td>
<td>$1250 to 2100</td>
</tr>
<tr>
<td>Sulfur Dioxide</td>
<td>2</td>
<td>310</td>
<td>&lt;0.5</td>
<td>$3000</td>
<td>$2900 to 3000</td>
</tr>
<tr>
<td>Particulates</td>
<td>3</td>
<td>27</td>
<td>&lt;0.1</td>
<td>$2000</td>
<td>$1250 to 2100</td>
</tr>
<tr>
<td>Volatile Organic Compounds</td>
<td>42</td>
<td>2142</td>
<td>&lt;1.0</td>
<td>$2500</td>
<td>$850 to 3250</td>
</tr>
</tbody>
</table>

*Mean price for a transaction at the end of 1985 as estimated by a knowledgeable offset broker.
**Price range for actual offset external transactions which took place during 1985.

69. 1983 is the first year for which such information is available.
71. 1985 was the first year in which offsets for pollutants other than volatile organic compounds were traded.
72. AER*X Corp. (1986) (unpublished report); South Coast Air Quality Management Dist., Final Air Quality Management Plan, 1982 Revision (stationary sources only on file with authors).
While the increase in trading activity from 1983 to 1985 indicates that an active market in offsets may be developing in the area, the significant variations in price and number of trades indicate that this market has not reached an equilibrium. A second indication of this disequilibrium is the fact that only a very small proportion of the total emissions in the area are being traded.\textsuperscript{73}

It is unlikely that insufficient demand can explain the absence of a smoothly functioning market in areas such as the SCAQMD because demand for offsets should be high in nonattainment areas experiencing economic growth. Therefore, the lack of an active market for offsets cannot be attributed to unwillingness of buyers; offset buyers must obtain offsets. Instead, the failure of an active market to emerge results from the lack of readily identifiable offset sellers.\textsuperscript{74} If transaction costs could be reduced, smoothly functioning markets might quickly develop in some areas of the country.

There is another economic advantage to using offsets, although it is difficult to quantify. When a firm decides to locate a major emission source in a nonattainment area, it knows that it must obtain offsets and meet stringent emission limits. The fact that it does not locate in an attainment area, where it would not need to obtain offsets, is a clear indication that the economic value of the nonattainment location outweighs the economic cost of obtaining offsets. While not easily measured, in our opinion this gain is significant in the aggregate.

Some evidence indicates that certain offset trades may not protect air quality in the manner intended.\textsuperscript{75} Due to inadequacies in the emission inventories used for SIPs and because allowable emissions frequently exceed actual emissions from existing sources, many offsets are created by revising the permit of an existing source to reflect an emission reduction that has already occurred.\textsuperscript{76} Nevertheless, because there have been only

\textsuperscript{73} Anecdotal evidence regarding the manner in which prices are determined also provides interesting insights into the nature of this market. In a 1982 study of offset transactions, including three in the SCAQMD, General Accounting Office researchers observed that firms constructing new emission sources found it difficult to identify potential sellers of offsets. However, when potential offset sources were located, the procedure for negotiating a price for the offsets generally involved the prospective buyer offering a price based on the seller’s expected cost for producing the offset. Although the price finally negotiated apparently sometimes exceeded that expected cost, the value of the offset to the purchaser seems not to have significantly affected the transaction price. \textit{GEN. ACCOUNTING OFFICE, supra} note 52, at 96. While offset prices in the SCAQMD have increased since that time, they are still set primarily by reference to sellers’ costs rather than the value to buyers. Palmisano interview, \textit{supra} note 64.

\textsuperscript{74} There are no ready means for buyers and sellers to identify each other. It is not unusual for buyers to pay fees of several thousand dollars for a consultant to assist in the search for offsets. Palmisano interview, \textit{supra} note 64.

\textsuperscript{75} \textit{R. LIROFF, supra} note 23, at 128-29.

\textsuperscript{76} \textit{DAMES & MOORE, supra} note 44, at 4-74 to 4-75; \textit{NAT’L COMM’N, supra} note 44, at 3.4 to 3.44.
about two thousand offset transactions and because regulators have generally been careful to ensure that these transactions have not had a significant adverse impact on air quality, we conclude that the total impact of offsets on environmental quality is not significant.77

B. Bubbles

Bubbles provide a way for a firm to increase emissions at one or more emission sources in exchange for larger decreases at other emission sources so that the total emissions from a facility do not exceed the sum of all the sources' individual emission limits. Two conditions must exist for a firm to have sufficient incentives to use a bubble. First, regulators must require the firm to employ an inefficient mix of emissions controls. Second, the marginal costs of emissions control for different sources operated by the firm must vary widely enough so that the cost savings from increasing the cost-effectiveness of the mix of controls justify the cost of the bubble-approval process.

The use of bubbles rarely involves external trading to acquire ERCs; all but two of the bubbles approved by EPA have involved only internal trades. One of these external trades involved a temporary lease of credits until a firm could meet emission standards by replacing a manufacturing plant; the other involved a purchase of credits.

Since its inception in 1979,8 the bubble policy has been a subject of controversy both inside and outside EPA for two reasons. First, bubbles are used in nonattainment areas, where reductions in emissions are needed to achieve ambient air quality standards. This has created controversy even though EPA has approved plans incorporating bubbles for many of these areas, plans that were projected to lead to compliance with air quality standards. Second, in some instances, firms have used (or tried to use) bubbles to avoid requirements for additional emission reductions.79

EPA has approved forty-two bubbles for firms emitting particulate matter, sulfur dioxides, and volatile organic compounds.80 Table 3 summarizes information about bubbles at different stages of development for each pollutant at the beginning of 1986.

77. See infra note 146.
79. See R. LIROFF, supra note 23, at 98-99 (describing history of controversy and various interest groups involved).
<table>
<thead>
<tr>
<th>POLLUTANT</th>
<th>Number Approved</th>
<th>Number Proposed</th>
<th>Number Being Developed</th>
<th>Reported Cost Savings</th>
<th>Reasons Reported</th>
<th>Emission Changes</th>
<th>Remarks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Particulate Matter</td>
<td>16</td>
<td>2</td>
<td>18</td>
<td>$95 million (6 firms)</td>
<td>Compliance (7 firms)</td>
<td>6 decreases</td>
<td>7 bubbles for steel plants or foundries; 2 for glass manufacturers</td>
</tr>
<tr>
<td>Sulfur Dioxide</td>
<td>12</td>
<td>0</td>
<td>11</td>
<td>$10 million fuel cost (8 firms); $17 million capital (1 firm)</td>
<td>Compliance (2 firms)</td>
<td>3 decreases</td>
<td>8 bubbles used oil/natural gas switches; 3 used other fuel switches</td>
</tr>
<tr>
<td>Volatile Organic Compounds</td>
<td>14</td>
<td>5</td>
<td>62</td>
<td>$10 million capital costs (5 firms)</td>
<td>Compliance (12 firms)</td>
<td>10 decreases</td>
<td>6 surface coating operations; 6 chemical manufacturers; 3 printing plants</td>
</tr>
<tr>
<td>TOTAL</td>
<td>42</td>
<td>7</td>
<td>91</td>
<td>$132 million (20 firms)</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

81. Regulatory Reform Staff, supra note 80; Office of Air and Radiation, supra note 80.
Emissions Trading

The 1987 deadline for meeting air quality standards for ozone spurred firms producing volatile organic compounds to use bubbles. The fifth column of Table 3 details reported cost savings of firms from the use of bubbles, almost all of which are large. Apparently, firms use bubbles only if they provide large cost savings. This is a reflection both of the expense of planning and preparing a bubble application and of firms’ judgments of the low probability of bubble approval.

In addition to bubbles approved by EPA, eighty-nine bubbles had been approved under state generic bubble rules as of 1984. Nearly all of these bubbles were for volatile organic compounds, which may be partially due to the fact that compliance deadlines had not yet expired for volatile organic compounds. However, it is primarily due to the fact that most states with generic rules for bubbles have such rules only for volatile organic compound bubbles.

Comparison of the number of bubbles under review for each pollutant and the pattern of bubble applications made by firms over time yields additional insight into bubble activity. Table 3 shows that while the numbers of bubble applications for the three pollutants are almost equal, many more bubbles for volatile organic compounds are being reviewed or developed than for total suspended particulates or sulfur dioxide.

Figure 1 shows the number of state and federal bubble applications under review for each pollutant.

82. This reflects the fact that large cost savings result when a firm switches from oil to natural gas in boilers, which is what most of these bubbles involve. In addition, this fuel switch can be accomplished at relatively low cost. Two caveats apply. First, firms may have an incentive to overstate their savings from bubbles in order to provide a stronger justification for EPA to allow the use of bubbles. Unless this overstatement is very large, it would not materially affect this conclusion. Second, it may be that firms are more likely to report their cost savings if those savings are large. However, there is no evidence that this is the case.

83. 1984 NATIONAL AIR AUDIT DATA, supra note 62. EPA approves state generic rules as part of a state's implementation plan. 33 of these bubbles were approved under generic rules reviewed and approved by EPA, and the remainder were approved under generic rules not approved by EPA. EPA can take enforcement action against firms with bubbles without EPA-approved generic rules, but the Agency's approach in practice is apparently to work with the states in order to get the generic rules approved in a manner which satisfies EPA requirements.

84. It is easier to get EPA approval for generic rules for volatile organic compounds. Comment from Michael Levin, EPA Regulatory Reform Staff, to Robert Hahn (Apr. 22, 1987) (discussing findings in this Article) (on file with authors).
Figure 1

Bubble Applications Under Review
January, 1985

Figure 2 shows the number of bubble applications EPA received each year between 1980 and 1984.86

Figure 2

Number of Bubble Applications Received By EPA
1980 - 1984

85. Regulatory Reform Staff, supra note 80.
86. These data include only those applications that have been approved or proposed for approval by EPA because these are the only bubbles for which application dates were available.
87. Regulatory Reform Staff, supra note 80.
Three factors explain the pattern of bubble activity. First, as the 1987 attainment deadlines approached, there was a strong movement towards use of bubbles. Figure 1 indicates that a large number of bubbles for volatile organic compounds were in the review and development stages as the 1987 attainment deadlines drew near. Figure 2 shows that the number of sulfur dioxide and particulate matter bubble applications declined after the compliance deadline for these pollutants passed in 1982. Apparently, large potential cost savings alone are not sufficient to induce some firms to use bubbles, since there is no reason to believe that potential cost savings declined after compliance deadlines passed.

As shown in Figure 2, a second factor influencing bubble activity was the uncertainty created among regulators and private firms by EPA's 1982 change in its bubble policy. In response to industry complaints about difficulties in the approval process, EPA instituted an interim policy intended to facilitate approvals. However, these actions created uncertainty among regulators, especially over what baselines to use in calculating emission reductions and whether credits from plant shutdowns could be used for bubbles. This uncertainty led EPA to impose an informal suspension on consideration of applications for bubbles in nonattainment areas. This action did not alleviate uncertainty, and thus some firms were probably discouraged from developing bubbles.

The third factor influencing bubble activity is the governmental unit that implements the program. States have approved over twice as many

89. The effect of attainment deadlines on the level of bubble applications is easily explained. Prior to a deadline, state regulators are free to determine how best to meet air quality standards. The state can grant a compliance extension to a firm based on an application for a bubble that will bring the firm's total emissions within the level set in the SIP. After an attainment deadline expires, however, EPA requires that the SIP demonstrate how it will meet air quality standards. State regulators can no longer grant compliance extensions to firms without EPA approval. Thus, the submission of bubble applications prior to a deadline may enable a firm to secure a compliance extension in order to implement the bubble. Extensions are unlikely for applications submitted after a deadline.
90. Given the 1987 attainment deadline for ozone, the number of applications for volatile organic compounds can be expected to decline after 1988. The extension of this deadline pending re-authorization of the Clean Air Act may also have the effect of postponing the period in which bubble applications can be expected to decline, although firms' reaction to the accompanying uncertainty about the effects of amendments to the Act make this difficult to anticipate.
92. See infra notes 151-55 and accompanying text (effect of uncertainty on level of emissions trading activity).
bubbles under generic rules as have been approved by EPA. States have approved more bubbles because state rules contain fewer steps in the review and approval process than do EPA rules. These additional steps are time consuming and costly to the firm submitting a bubble application.

EPA estimated in 1985 that the 42 bubbles it had approved had resulted in cost savings of $300 million and that potential cost savings from the more than 200 bubbles in the United States, including those approved by the states and those under review or development, amounted to over $800 million. Although EPA's cost savings estimates may be somewhat high, bubbles clearly produced substantial cost savings. This is impressive evidence that firms can and will take advantage of the flexibility offered by emissions trading to reduce emissions control costs in spite of the incremental nature of bubble policy implementation. Firms choosing to apply for bubbles have done so in the face of considerable uncertainty deriving both from EPA's delays in resolving questions about its bubble policy and from the uncertainty associated with a new program.

As of 1986, at least 89 generic bubbles have been approved by states as compared to 42 EPA-approved bubbles.

To get a bubble approved by EPA requires the additional steps of Regional Office review, review at EPA Headquarters, a notice of proposed approval in the Federal Register and a subsequent public comment period, and notice of final approval in the Federal Register.

As noted, the prevalent use of state-approved bubbles may also be due in part to the uncertainty that existed under the 1982 EPA bubble policy.


EPA apparently attributes average savings of approximately $3 million to each bubble approved under state generic rules. As noted above, most state generic bubble rules apply only to volatile organic compounds. For EPA-approved volatile organic compound bubbles, the maximum capital cost savings reported was $3 million. The potential cost savings need not be as high to justify going through the bubble permitting process under state generic rules as they must be to justify going through the more expensive EPA-approval process. Therefore, average cost savings from state-approved bubbles are likely to be lower than those from EPA-approved bubbles. An estimate of the average savings for bubbles approved under state generic rules of $1.5 million is probably more reasonable. This would put savings from the 89 state-approved bubbles at approximately $135 million, and total potential savings from all bubbles at approximately $650 million. This includes the 49 bubbles approved or proposed for approval by EPA, the 89 approved by the states, and the 91 reported to be under review or development. This estimate is intended to reflect one-time cost savings for firms. It is difficult to discern in many cases whether the cost savings reported to EPA are capital costs only or whether some savings in annual operating costs are included. In the few cases where both types of savings have been reported separately, capital cost savings have generally been much more significant than operating cost savings.

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The current level at which bubbles are used clearly does not reflect the potential impact of the program. Moreover, the fact that only two hundred bubbles have been used shows that this policy has not led to the development of a market in emission credits. If firms use bubbles primarily to comply with emission limits, but can no longer do so because the 1987 attainment deadlines have expired, then bubble activity can be expected to decline in the absence of changes in bubble policy.

The effect of bubbles on environmental quality is unclear. One EPA official reported that the majority of bubbles led to "substantially greater emission reductions than conventional limits, with the rest producing equivalent reductions." Evidence from another EPA office indicates, however, that although some bubbles may reduce allowable emissions, they have little or no impact on actual emissions and few lead to significant emission reductions. Thus, although we recognize that a few bubbles have enabled firms to avoid making emission reductions that they otherwise would have been required to make, there is no evidence to indicate what precise effects bubbles have had on air quality. We conclude that the net impact of bubbles on environmental quality has not been significant.

C. Banking

Since EPA approval in 1979, banking has provided a means for a firm to save emission credits. Because states are not required to establish banking programs, the ability of a firm to bank credits depends upon the existence of a state regulatory program. Such a program must assess the quantity and validity of banked emission credits and specify the rules for using these credits.

Firms bank emission credits if doing so establishes a property right in

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102. To our knowledge, only two of these bubbles involved external trading.
103. See infra notes 175-88 and accompanying text (discussion of EPA's emissions trading policy).
104. Levin, The Supreme Court's "Bubble" Decision: What It Means, EPA J. 11 (1984). Levin was the head of EPA's Regulatory Reform Staff, an office which is the primary advocate of emissions trading within EPA. It is clearly in the interest of emissions trading advocates to emphasize gains in environmental quality which result from emissions trading.
105. This conclusion is based on analyses contained in Revised Reviews, supra note 80 (compilation of data for permits 1-20); Initial Review, supra note 80 (compilation of data for permits 21-37). These reports indicate the difficulty of assessing the environmental impact of bubbles which encompass several production processes. They also illustrate how difficult it is to assess the impact on environmental quality of bubbles in which shutdowns of existing sources have been used to provide reduction credits, since this requires some determination of what would have happened if a bubble had not been used.
an asset that has a value at least equal to the cost of creating the asset. Banked emission credits are valuable assets because they can be used as offsets or for netting. In addition, these credits may be sold to other firms. In theory, banking should reduce the uncertainty surrounding a firm's ability to use completed emission reductions in future emissions trading transactions. In practice, however, the potential for changes in emission control requirements raises the possibility of confiscation or elimination of banked emission credits, thus discouraging firms from banking.

Banking has had limited use because state and local rules that allow banking must be approved by EPA. As of 1986, EPA had approved banking rules for only five state or local agencies. Eight more agencies had adopted banking rules, some of which were submitted to EPA for review. Of all these programs, only the banking program in Louisville, Kentucky can be described as active. Eighteen firms have deposited 26,000 tons per year of emission credits into this bank. In addition, two firms with EPA-approved bubbles have used credits from this bank. The bank has provided offsets for nine external trades and nineteen internal trades. This activity can be attributed to two factors. First, this program places few restrictions on the use of banked credits and its rules for trading are clear and detailed. Second, the bank facilitates a smoothly functioning market by maintaining a public ledger that enables buyers to locate potential sellers easily.

Other banking programs have had little activity either in terms of emission credits banked or in terms of internal or external transactions involving banked credits. This lack of activity has two causes. First, there is

108. See infra notes 125-44 and accompanying text (discussion of netting).
110. Although many banking programs have been established by local agencies, this Article does not distinguish between state and local regulatory agencies.
111. Oregon; Missouri; Rhode Island; Lane County, Oregon; and Puget Sound, Washington.
112. Pima County, Arizona; Jefferson County, Kentucky; Middlesex County, New Jersey; Allegheny County, Pennsylvania; and four air pollution control districts in California. In addition, at least seven other agencies are developing or considering banking rules. Status Report, supra note 98, at 2. 18 states expressly forbid banking or have regulatory officials who have expressed antipathy toward banking. ELI, supra note 49. The remaining state and local regulatory agencies have not developed either banking rules or a position on banking.
113. Telephone interviews with Michael DeBusschere, Air Pollution Control Officer, Jefferson County Pollution Control District (Kentucky) (Aug. 21, Sept. 16, Sept. 22, 1986); telephone interview with David Bray, EPA Region X (Sept. 4, 1986); telephone interview with John Anderson, Puget Sound Air Pollution Control Agency (Sept. 8, 1986).
114. Id.
115. Id.
116. See infra notes 156-60 and accompanying text (discussion of negative effect of transaction costs).
117. Telephone interviews with officials from state or local agencies with formal banking (notes on file with authors).
often little potential for using banked emission credits. For example, although Rhode Island has a banking program, because it is an attainment area, there is no need for firms to use offsets for new or modified emission sources. Thus, no firms have applied to bank emission credits. Furthermore, restrictions placed on the use of emission credits, such as limiting their use to offsets or to internal use, make them even less useful.

The second reason for a lack of banking activity is the uncertainty surrounding the nature and value of the property right in banked emission credits. Confiscation of banked emission credits remains a concern for firms. Several banking programs incorporate provisions for banked emission credits to be discounted or partially confiscated by state regulators if certain events occur. When a state or local regulatory agency is unable to comply with air quality standards, these banked emission credits may be reduced or eliminated entirely. Time limits on the validity of banked emission credits also create the potential for confiscation. Many banking rules contain limits on the life of banked emission credits. If a firm intends to use its own banked emission credits, there may be uncertainty about whether it will be able to employ the credits during their useful lifetime; if the firm intends to sell banked emission credits, this uncertainty is compounded because the firm cannot anticipate when an opportunity to sell the credits will arise. The possibility that banked emissions credits may be confiscated, through discounting, regulatory change, or limits on the credits’ lives, has clearly discouraged firms from engaging in banking.

The current level of banking activity is far less than expected; thus it has had little effect in terms of either cost savings or improved air quality. Emission credit banks promote environmental quality only when a firm banks emission credits in order to reduce emissions beyond regulatory requirements. The small number of deposits in emission credit banks indicates that few firms are creating and banking credits for their asset value. As a result, banking has not improved environmental quality.

In addition to banks established under formal rules, commonly called “formal banks,” at least twelve state or local agencies allow “informal

118. See supra notes 64–74 and accompanying text (discussion of impact of being within a nonattainment area); see also R.I. Air Pollution Control Regulations § 9.1.3 (uncodified administrative regulations).

119. This type of provision is included in banking rules in Kentucky.


121. R. Liloff, supra note 23; Gen. Accounting Office, supra note 52.

122. See supra note 113.
banking.” A few of these agencies also have established formal banks.\textsuperscript{128} Details regarding the operation of informal banks are difficult to obtain because they are not governed by written rules in most cases. They generally involve informal arrangements between firms and regulators that allow the saving of emission reductions greater than those required by regulations—without a change in the firm’s operating permits—for future use in internal emissions trading transactions. Informed sources indicate that there may be more informal banking than formal banking.\textsuperscript{124}

Firms using informal banking may realize significant cost savings for two reasons. First, by using informal banking, firms reduce emissions control costs because this type of banking enables firms to use prior emission reductions to avoid the cost of complying with new reduction requirements. Second, firms realize reduced permitting costs when informally banked emission reductions are used for netting transactions.

Unfortunately, informal banking does not provide information for external trades. In fact, it restricts the use of emission credits to internal transactions, since no regulatory agency allows the use of informally banked emission credits in external transactions unless they are converted to formally recognized emission credits through changes in operating permits. As a result, the existence of informal banks may actually impede the formation of markets for emission credits. In contrast, formal banks that make records of deposits public are more likely to promote market formation because they provide a means for sellers to identify buyers.

D. \textit{Netting}

Netting allows a firm to increase emissions from one source if it decreases emissions from another source so that the net increase does not equal a major source.\textsuperscript{125} In doing so, a firm that is modifying an existing emission source can avoid the most stringent emission limits and experience fewer complications in obtaining a permit.\textsuperscript{126} The basic premise of netting is that if a source modification results in an emissions increase that is less than if the source were classified as major, the source modification

\textsuperscript{123}. ELI, \textit{supra} note 49; \textit{Gen. Accounting Office, supra} note 52.

\textsuperscript{124}. Ritts interview, \textit{supra} note 63; Telephone interview with Charles Bausell, Researcher, General Accounting Office (Aug. 20, 1986).

\textsuperscript{125}. Netting permits internal trading, not external trading. A firm may engage in netting whether the existing modified source is classified as major or minor. However, the firm must obtain a minor source permit and the source must comply with the emission limits in that permit. The modified source is also subject to any additional permit requirements that are contained in SIPs and to minimum emission limits set by EPA. However, none of these limits or requirements are as stringent as those that would apply to the source if it were to go through the permitting process as a major new source, as it would have to if netting were not used.

\textsuperscript{126}. An “existing source,” in this context, can be an entire plant containing many individual points at which emissions are produced.
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will not significantly harm air quality. Thus, the net change in emissions resulting from netting can be positive, and may be barely below the major-source level set by the state regulatory agenda.\textsuperscript{127}

Netting has been allowed in varying forms since 1974. EPA estimated that by the end of 1984, "several hundred" firms had used netting.\textsuperscript{128} From available data it appears that netting is the most commonly used emissions trading activity by a wide margin. In 1984, the only year for which detailed data are available, an estimated 900 sources used netting.\textsuperscript{128} This is about fifteen times as often as offsets were used during the same year, and it is far more often than bubbles have ever been used. Given the degree of uncertainty associated with extrapolating from one year's data, it is reasonable to estimate that approximately 5000 to 12,000 sources have used netting since 1974, with 8000 being the most probable value within this range.\textsuperscript{130}

\textsuperscript{127} Depending on the state and the pollutant involved, this emission level may be as high as 250 tons per year. 1984 \textit{National Air Audit Data}, supra note 62.
\textsuperscript{129} In 1984, state and local agencies issued 17,148 permits to new and modified sources. EPA examined 360 permits issued to minor sources in detail. Of these, 21 were sources that would have been considered major on the basis of the emissions from their modifications, had they not used netting. This is a conservative estimate because it includes only permits for which the data obtained clearly indicate that the modified source would have been major had netting not been used. Information on several other permits indicated that the sources may have used netting, but inconsistencies in data entries made it impossible to make a definitive determination.

These 21 permits represent 5.9% of the 360 permits examined. Assuming that a similar percentage of the 15,303 minor sources receiving permits in 1984 used netting, about 900 sources receiving permits in 1984 used netting. Only 57 major source nonattainment area permits, which required offsets, were issued during the same period. Thus, about fifteen times as many permits issued in 1984 involved netting as involved offsets. 1984 \textit{National Air Audit Data}, supra note 62.

Note that this estimate is based on the assumption that netting took place with equal frequency, relative to the number of minor-source permits issued, in attainment areas and nonattainment areas. It might also be reasonable to assume that netting took place only in attainment areas. During about half of 1984, a Federal Circuit Court ruling against the use of netting in nonattainment areas was in effect. Natural Resources Defense Council, Inc. v. Gorsuch, 685 F.2d 718 (D.C. Cir. 1982), \textit{rev'd sub nom.}, Chevron U.S.A., Inc. v. Natural Resources Defense Council, Inc., 467 U.S. 837 (1984). If one assumes that the proportion of all minor-source permits issued in attainment areas is similar to that for major-source permits (67%), and that only minor sources in attainment areas used netting in 1984, then approximately 600 minor sources used netting in 1984. The object here is not to estimate the exact number of sources that used netting, but rather to make a reliable estimate of the relative magnitude of netting transactions compared to other emissions trading activities. During the history of the netting program, from 1974 to the present, there have certainly been periods when little or no netting took place in nonattainment areas. However, we are unable to make any estimates of the duration of these periods that are sufficiently accurate to fine tune our estimate of total netting activity. Therefore, our estimates of netting activity are based on the assumption that it took place in both attainment areas and nonattainment areas throughout its history.

\textsuperscript{130} This estimate must take into account the following factors: (1) of those sources that could have used netting, the proportion that has actually done so has probably increased over time as firms become more familiar with the possibilities of emissions trading; (2) regulations and court decisions on netting have changed over time so that netting opportunities have been more or less constrained at different times; and (3) fluctuations in economic activity have influenced the number of major modifications of sources over time. Since data to support an exact estimate of the effects of these factors are
The data also indicate that a similar number of firms receiving minor-source permits in 1984 avoided being classified as major sources by agreeing to state permit restrictions on operating conditions for the new source or modification being permitted. Examples of such restrictions include limitations on the annual hours of operation and constraints on the type or sulfur content of fuels used. Although such restrictions are not technically a part of emissions trading, the result for the firm receiving the permit is the same as the result of netting. Classification as a minor source avoids the permitting, modelling, monitoring, and some of the emissions control requirements to which a major source would be subject.

Estimating the total cost savings from netting is difficult because of the uncertainty surrounding both the number of netting transactions and the varying cost savings to individual firms. There are generally two sources of potential cost savings that may result from netting. First, netting enables firms to reduce emissions control costs when classification as a major source would subject the firm to more stringent emission limits. The magnitude of emissions control cost savings from netting varies ac-

not available, an estimate with a wide range to reflect uncertainty about the exact number of netting transactions is appropriate. The average number of netting transactions per year since 1975 probably falls between the 1984 estimate of 900 (if firms net in both attainment and nonattainment areas) and 600 (if firms net only in attainment areas). See supra note 129. If an average of 750 netting transactions took place during those years, 8000 total transactions would have occurred.

131. Of 15,139 minor sources receiving permits in 1984, 761 avoided being permitted as major sources through use of such restrictions. Texas did not supply information on this aspect of its permit writing. As a result, the total number of minor permits differs slightly from the preceding analysis. 1984 NATIONAL AIR AUDIT DATA, supra note 62.

132. New major sources locating in nonattainment areas must comply with EPA's Lowest Achievable Emissions Rates (LAER), which require the most costly and technologically advanced emissions controls. Even in areas never classified as nonattainment, new major sources may have to implement the Best Available Control Technologies (BACT), which is also a very stringent standard. Sources classified as minor may still be subject to EPA's New Source Permit Standards (NSPS), but if NSPS do not apply, or if NSPS requirements are less onerous than LAER or BACT, netting will significantly reduce emission control costs.

Available evidence indicates that a high proportion of sources using netting would not be subject to any NSPS. A 1986 study concludes that NSPS only apply to 32% of non-utility major new sources. L. Hayes, M. Baviello & G. Sugiyama, (paper presented at the Air Pollution Control Ass'n Ann. Meeting) (1986) (on file with authors). Our own analysis of 197 BACT and LAER determinations made in 1984 indicates that roughly 50% of the firms using netting would avoid NSPS emission limits as well as BACT or LAER. 1984 NATIONAL AIR AUDIT DATA, supra note 62. Another study conducted in 1983 found that only one of twelve modified sources studied which used netting was subject to NSPS. ETA ENGINEERING, INC., NETTING OUT OF NEW SOURCE REVIEW: THE EXPERIENCE IN ILLINOIS 10 (1984) [hereinafter ETA] (report prepared for EPA Regulatory Reform Staff) (on file with authors). While not conclusive, this study tends to support the view that sources not subject to an NSPS will be the most frequent users of netting. The possibility that additional limits in state implementation plans apply to sources using netting complicates the issue of emission control cost savings, but does not fundamentally alter the preceding analysis.

However, if NSPS do apply, "the general tendency is to specify [BACT or LAER] emission limits equivalent to NSPS." DAMES & MOORE, supra note 44, at 4-6. Sources which would be subject to NSPS after netting would thus often realize no savings in emission control costs. Their only incentive to use netting would be the potential savings in permitting costs.
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cording to individual circumstances, such as control costs and the emission limits to which a firm is subject after netting. A 1983 study of netting in Illinois found that "a 200 ton [per year] controlled emission level" volatile organic compound emission source might save one million dollars in control costs by using netting. However, this study's authors have indicated that this level of savings may be higher than the average savings from netting. Moreover, any netting savings would be somewhat offset by the cost of achieving the emission reductions. Thus, we estimate a reasonable range of estimated average cost savings is $100,000 to $1 million per source. This calculation yields a range of total estimated cost savings of $500 million to $12 billion. The lower end of this range is approximately equal to the total estimated savings from bubbles. Hence, it appears that netting is the most frequently used emissions trading activity and it has yielded the greatest aggregate cost savings.

Firms also realize cost savings from netting because they avoid the permitting procedures that apply to major sources. These procedures consist of preparing permit applications, modelling air quality impacts, and monitoring emissions. A 1982 EPA report indicated that the total costs for these procedures ranged from $6800 to $25,000 with an average of about $15,000. Although preparing the permit application itself adds costs, these costs do not differ significantly for major sources and sources using netting, since approval of netting requires significant interaction with regulators. Thus, a reasonable estimate of the range of average permitting cost savings from netting is $5000 to $25,000. The estimate of 5000 to

133. ETA, supra note 132, at 11. In the EPA data used to estimate the total number of netting transactions, the mean emission rate for individual pollutants from the 21 sources that used netting was 307 tons per year, and the median emission rate for individual pollutants from these sources was 206 tons per year. 1984 NATIONAL AIR AUDIT DATA, supra note 62. If these figures are typical of all sources using netting, then savings of $1 million might be typical of netting transactions in general.


135. This is the estimated capital cost for equipment and measures necessary to meet the emission limits that were avoided by using netting. It does not include operating costs. These figures are not adjusted for inflation.

136. See supra notes 98-100 and accompanying text.

137. Because external trading is not permitted with netting, these savings result from internal trading. See supra note 121.

138. Data collected on 81 PSD area major source permits issued in 1984 indicate that 37 (46%) were required to undertake pre-construction monitoring, 45 (56%) were required to do "increment analysis" modelling, and 62 (77%) were required to do air quality analyses. In contrast, only 81 (23%) of 360 sources receiving minor source permits studied were required to do air quality analyses. 1984 NATIONAL AIR AUDIT DATA, supra note 62.


140. Regulatory Reform Staff, supra note 80 (finding savings of up to $100,000 for firms in this category using netting).
12,000 total netting transactions yields an estimate of permitting cost savings of $25 million to $300 million.

In addition to producing these cost savings, netting allows firms to avoid the delays in approval of construction that occur as a result of going through a major-source permit process. Indeed, according to Illinois state officials, “the avoidance of delay and permit negotiation were ranked highest” among the incentives for firms to use netting, ahead of savings in control costs. Hence, while not quantifiable, the potential significance of this factor should not be overlooked.

Netting is designed to have little impact on environmental quality. If the emission reductions firms use in netting are reductions in actual emissions, then these firms will increase their total emissions by quantities that fall below the major source thresholds. States set these thresholds at low levels so that the impact on air quality should be insignificant. However, if many firms with modified sources use netting in a single area, this may have an adverse impact on local air quality. This negative impact will be significant only when several sources are netting without reducing actual emissions.

As noted above, state regulators review and approve netting, and they have the discretion to impose permit conditions requiring additional emission reductions if netting has adversely affected local environmental quality. Thus, netting has probably not had a significant adverse impact on environmental quality.

For all its benefits, netting does not promote markets in emission credits. All netting transactions are internal trades because emission credits obtained through external trades may not be used in netting. Netting may even discourage the formation of markets because firms save emission reductions for their own use rather than sell them to other firms.

IV. Explaining the Performance of Emissions Trading

Table 4 summarizes emissions trading activities and their impact on emissions control costs and environmental quality. Table 4 reveals that emissions trading as a whole has led to cost savings in the billions of dol-

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141. ETA, supra note 132, at 12.
142. Even if such paper credits are used in many cases, they reduce a firm’s discretion to use their emissions because the reductions in allowable emissions become enforceable by state regulators.
143. One study of the environmental impact of netting concludes that “[i]n all likelihood the impact of netting in nonattainment areas [in Illinois between 1983 and 1987] would be much lower than one percent [increase in total emission levels].” ETA, supra note 132, at 18.
144. Id., at 9; NAT’L COMM’N, supra note 44, at 3.4 to 4.8; GEN. ACCOUNTING OFFICE, supra note 52, at 55, 65, 93.
145. Cost savings for netting are stated in terms of 1984 dollars, since they are based on an estimate of savings for a typical firm using netting that year. Cost savings for bubbles are stated in terms of current dollars at the time each bubble was approved. Bubble cost savings are based on both EPA estimates and data reported by firms using bubbles.
lars and has had a negligible effect on environmental quality.\textsuperscript{146} The fore-going examination of the individual components of emissions trading leads to four observations.

1. Netting is the most frequently used activity, followed by offsets and then bubbles. Offsets are mandatory for new sources in nonattainment areas, so it is not surprising that they are used often. The use of netting is surprising when one considers that netting can only be used by firms when they are modifying an existing source, whereas bubbles can be used by firms with existing sources, which far outnumber new and modified sources. Thus, many more firms would appear to be in a position to benefit from bubbles than from netting.

2. Most trading is internal. This is surprising because the differences in marginal emissions control costs necessary to make trading advantageous appear more likely to exist if more than one firm’s sources are involved in a trade.\textsuperscript{147} Therefore, one might expect that external trading would occur more frequently than internal trading. However, the predominance of internal trading is less surprising if one considers the high transaction costs associated with identifying buyers and sellers and obtaining approval of external trades.\textsuperscript{148}

3. Activities controlled and regulated by the states, such as netting and offsets, are used by firms much more frequently than the federally-controlled bubble program. Even generic bubbles, which are available to firms in only a few states, have been used more frequently than EPA-approved bubbles.

4. Banking activity is almost nonexistent. Banking might be expected to be the backbone of emissions trading because of the four elements of emissions trading, it has the greatest potential of bringing together buyers and sellers. In fact, banking has been almost totally ineffective in promoting trading activity.\textsuperscript{149}

\begin{itemize}
  \item \textsuperscript{146} The assessment of the effect of emissions trading on environmental quality presented in this Article is primarily based on the fact that the rules governing the various trading programs contain prohibitions against trades that would result in significant increases in emissions. Statements of state and federal regulators interviewed for a study of emissions trading commissioned by EPA provide evidence that these safeguards have been effective. “In general, the [regional and state personnel interviewed believe that emissions trading has not harmed air quality.” S. CONNOLLY, supra note 44, at 28.
  \item \textsuperscript{147} The more sources there are, the more likely these differences exist. Similarly, the more firms potentially participating, the larger the amount of potential sources.
  \item \textsuperscript{148} See infra notes 155–60 and accompanying text.
  \item \textsuperscript{149} See supra notes 110–20 and accompanying text.
\end{itemize}
<table>
<thead>
<tr>
<th>Activity</th>
<th>Estimated Number Of Internal Transactions</th>
<th>Estimated Cost Savings (Millions)</th>
<th>Environmental Quality Impact</th>
</tr>
</thead>
<tbody>
<tr>
<td>Netting</td>
<td>$5,000 to $12,000</td>
<td>Probable, but not easily measured</td>
<td>Insignificant in aggregate</td>
</tr>
<tr>
<td>Offsets</td>
<td>1,800</td>
<td>$300</td>
<td>Insignificant</td>
</tr>
<tr>
<td>Bubbles:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Federally</td>
<td>40</td>
<td></td>
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</tr>
<tr>
<td>Approved</td>
<td></td>
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<tr>
<td>State</td>
<td>89</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Approved</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Banking</td>
<td>&lt;100</td>
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</tbody>
</table>
Nothing by itself can explain all aspects of emissions trading. However, the cumulative effect of three factors explains much about the pattern of emissions trading activity: first, the different regulatory treatment of new and existing emission sources; second, uncertainties associated with property rights; and third, transaction costs for firms attempting to buy or to sell credits.

A. Regulatory Treatment of New and Existing Emission Sources

The regulatory system established under the Clean Air Act places a substantial burden on new sources of emissions because it imposes more stringent emission limits on new sources than on existing sources. As a result, new sources are at a competitive disadvantage. Netting, when feasible, is a very effective tool because its use results in a modified source that avoids the more stringent emissions control standards that apply when an entirely new major source is created. Thus, it is not surprising that a firm uses netting whenever feasible. In contrast, bubbles are used by unmodified existing sources to meet emission limits. In both attainment and nonattainment areas, the requirements for existing sources are usually significantly less stringent (and less costly to implement) than those for new sources. Therefore, most existing sources are not nearly as hard pressed as are new sources to reduce their emissions. This partly explains why there are few bubbles in comparison to the apparent number of firms that could use them.

Sunk costs are another key difference between new and existing sources. New sources have no sunk costs; therefore firms can take advantage of the flexibility afforded by emissions trading. Firms with existing sources are likely to have invested in emissions control equipment, thereby constraining their ability to adjust emissions control strategies. Because bubbles were not allowed until 1979, seven years after the amendments to the Clean Air Act that dictated the current approach to improving air quality were enacted, those firms that invested in emissions control equipment (and thus incurred costs that are now sunk) during the period from 1972 to 1979 did so unaware of the potential of bubbles. The amount of investment by firms in pre-bubble technology helps to explain why firms are not currently taking advantage of bubbles as widely as might be expected.

150. The rationale for this system is that because existing sources will eventually be replaced by new ones, there will be a gradual increase in emission reductions because new sources must use the most effective emissions controls. However, the bias against new sources also provides an incentive for firms to maintain their existing plant and equipment for a longer period than they otherwise might have.
B. Uncertainty Concerning Property Rights

Uncertainty about property rights was mentioned earlier as one factor causing a lack of banking activity. Banking rules are often ambiguous about how rights in emission credits can be established and used, thereby creating uncertainty that reduces a firm's incentive to use emission banks. Similar uncertainties about property rights have made internal trading a more attractive alternative than it might otherwise be. As previously described, firms face considerable uncertainty in anticipating how regulators will determine their baseline emission levels and emission reductions for emissions trading purposes. In making an external trade, firms face the even greater uncertainty associated with calculating these factors for another firm. If credits are to be obtained by external trading, firms must know whether the potential seller is really going to be able to make the emission reductions necessary to create the credits. If so, the firm must know whether regulators will officially recognize the creation of the credits and the right of the seller to transfer them to the buyer. Firms cannot answer these questions with as much confidence as they can when making internal trades. Because firms value certainty when considering major investments, they are likely to find internal trading advantageous, even if emission credits might be acquired at a lower cost through an external trade.

C. Transaction Costs

Transaction costs also play a major role in a firm's decision about whether to use emissions trading and whether to trade internally or externally. As shown above, uncertainty about property rights causes firms to choose internal trading over external. Transaction costs associated with an external trade also stem from the search for sellers of emission credits. Without banking programs to provide an efficient means for firms to identify holders of emission credits, the task of finding willing sellers of credits can be formidable. Furthermore, a firm searching for credits has no

151. See supra note 119–21 and accompanying text.
152. Id.
153. See supra notes 46–53 and accompanying text (discussion of effect of uncertainty on calculations).
154. Uncertainty about official recognition of emissions reductions is exacerbated by the poor quality of information in state emission inventories. See supra notes 17 & 44.
155. The exception to this occurs when a potential seller has already banked credits. However, only a small number of firms have banked credits. See supra notes 111–15 and accompanying text.
156. The perspective of buyers of credits is adopted here because firms buying credits make decisions about whether to use internal or external trading. Sellers of credits also face search costs and may have the option to use their credits internally.
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market information from which it can anticipate the future price of credits. If a firm has the option of generating credits internally, it may choose to do so rather than incur the expense of a search for credits when the outcome of the search is unpredictable. The dominance of internal trading indicates that many firms have made this choice.

Transaction costs are also incurred in obtaining regulatory approval for an emissions trade. The federal-approval process for bubbles is much more costly and lengthy than for many state-approved emissions trading activities, thereby creating a great incentive for firms to use forms of emissions trading under state control—generic bubbles, netting, and offsets.

V. Understanding the Political Environment

The controversy surrounding emissions trading has led to a variety of proposals for modifying the program. To evaluate specific reform proposals, it is necessary to understand not only the legislative and regulatory foundations of emissions trading, but also the political environment that has given rise to the current emissions trading program. The political environment is just as important in determining the scope and success of potential reforms of emissions trading as are the constraints imposed by the Clean Air Act.

The evolution of the emissions trading program can best be understood as a continuing struggle over the nature and distribution of property rights. The three key groups involved are environmentalists, industry, and regulators. They focus not only on measurable outputs, such as costs

158. See supra note 74 and accompanying text.
159. See supra notes 95–97 and accompanying text (discussion of state and federal bubble approval processes).
160. Two other factors that place firms using federal bubbles at a disadvantage relative to users of state-controlled emissions trading activities are the high degree of scrutiny given by opponents of emissions trading to federally-controlled activities and the greater willingness of many state regulators to accommodate the needs of firms.
161. See infra notes 171–93 and accompanying text (general discussion of reform proposals).

This taxonomy is a convenient simplification. Obviously different industries will have different agendas, as will different environmental groups. Nonetheless, this taxonomy is useful for exploring
and environmental quality, but also on underlying values. While not attempting to capture every aspect of this conflict, this Part provides a paradigm that explains how the emissions trading program developed.

A. Environmentalists' Concerns

Environmentalists have consistently questioned the merits of emissions trading, arguing that environmental quality objectives have been sacrificed for economic efficiency. However, there is another, deeper sense in which environmentalists oppose this reform. A fundamental premise of emissions trading is that explicit trading of emission rights is legitimate. Many environmentalists reject this premise, regardless of the anticipated effect of emissions trading on environmental quality. For some, it is an issue of morality: clean air is a basic inalienable right that is not for sale at any price. Even for those who do not take this absolute moral position, there is a symbolic issue. Allowing firms to trade emission rights sends a message that decisions about tradeoffs between economics and environmental quality can be left to the polluters. In addition to its immediate effects, this message may in the long term shape national attitudes in ways that are antithetical to environmentalists' views. For these reasons, environmentalists have been almost unanimous in their opposition to emissions trading. 163

B. Industry's Goals

Industry's response to emissions trading has been more diverse because of conflicting motivations underlying industry behavior. It is generally assumed that firms wish to reduce their expenditures on environmental controls. Less widely recognized is the fact that industry has a strong preference for greater certainty in environmental regulation. Thus, the potential cost reduction that can be achieved under emissions trading policies may not be worth the uncertainty that is created by participation. This view is confirmed by the fact that firms generally have not used bubbles except when they face compliance deadlines. 164 When they have the option, firms tend to comply with limits contained in existing permits, which involves little or no uncertainty.

many of the features of environmental regulation and, in particular, emissions trading.


164. See supra note 89.
C. Regulators' Dilemma

The countervailing pressures of industry and environmentalists are brought to bear on a third key interest group—regulators. Regulators attempt to implement laws and to develop regulations in ways that minimize conflict among interest groups. With emissions trading, regulators have attempted to provide industry with increased flexibility while offering environmentalists improved air quality. Meeting these two objectives has required a careful balancing act. To provide industry with flexibility, regulators have defined a set of property rights and placed minimum restrictions on their use. At the same time, they have been sensitive to the concerns of environmentalists regarding the definition of these rights. Thus, they have created policies specifically designed to de-emphasize the nature of the property right. For example, instead of being explicitly called "tradable emission permits," regulators use names such as "emission reduction credits" and "offsets."\(^1\) Neither of these terms clearly conveys the notion that rights to emit pollutants are being exchanged.

The problem in defining property rights goes beyond developing acceptable names. One of the continuing difficulties encountered in emissions trading is determining what entitlements accompany the right. Regulators are reluctant to define property rights in a way that resolves the uncertainty concerning their use in external trades due to potential criticisms from environmentalists. Moreover, they tend to give these rights an inferior status for the same reason. For example, banked emission credits are sometimes subject to a "discount", a *de facto* partial confiscation, while informally banked rights are not.\(^2\) As noted in the previous section, banking has had only a small impact on actual trading. Yet its use has been quite controversial. This controversy has a number of causes; one that certainly affected banking is the belief of environmentalists that the very activity of banking lends legitimacy to the trading of rights. Informal banks enable state regulators to afford firms flexibility while avoiding the criticism of environmentalists.

Arguably, the most important tangible concern of environmentalists regarding emissions trading is the effect it has, and will have, on environmental quality. Federal regulators attempted to address this concern by designing a system in which trades are approved only if they can be shown to have a benign impact on environmental quality.\(^3\) When EPA

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166. See *supra* note 117 and accompanying text.
released its "Final Emissions Trading Policy" in 1986, the Agency issued explicit guidelines and required a high degree of central oversight on policies within its direct jurisdiction—most notably the bubble policy. Whether firms and/or regulators have adhered to these guidelines is debatable, but federal regulators clearly have taken great care in addressing this issue.

This paradigm of interest group interaction explains much about the development and performance of emissions trading to date. In particular, it helps explain two features affecting the performance of the program previously identified: uncertainties associated with property rights and high transaction costs due to a lack of an efficient credit market. The uncertainty surrounding the existence of tangible property rights is largely due to conflicts over the definition of those rights. Transaction costs exist, in part, because of the requirements imposed on trading by regulators to assure environmentalists that a trade will be approved only if it has no adverse effect on environmental quality.

Regulators at both the state and federal levels will continue to respond to pressure from environmentalists and industry as emissions trading continues to evolve. These interactions constrain the scope for change in emissions trading and must be taken into account. Proposals for reform that ignore these constraints run the risk of being irrelevant for policy makers.

VI. Evaluating Proposals For Reform

In evaluating reform proposals, it is important to select criteria that provide useful summary information on the state of the existing system and proposed alternatives. The analysis presented below utilizes emissions control costs and environmental quality. The existing regulatory sys-

170. The third feature, that of the difference in regulatory treatment of new and old sources, can also be traced to the struggle between environmentalists and industry. A detailed explanation of this feature is beyond the scope of this paper. Briefly, however, regulators (and Congress) have responded to the most pressing concern of industry by assuring that existing emission sources would be subject to the least stringent emission control requirements. They addressed environmentalists' desire for improved air quality by imposing the most stringent control requirements on sources that will be created in the future. Their rationale was the belief that new sources would replace existing sources over time until all remaining sources are stringently controlled. For an incisive analysis of the politics motivating new source performance standards, see B. ACKERMAN & W. HASSLER, supra note 162.
171. In addition to the direct costs of emissions control, this analysis considers factors such as uncertainty and cumbersome administrative procedures that add to the cost of using emissions trading.
172. While we believe other criteria are important, such as the effect reforms have on process, values, and ease of administration, this type of analysis is beyond the scope of this Article. Furthermore, control costs and environmental quality correspond closely to the primary concerns of industry and environmentalists, respectively.
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tem is used as a benchmark for evaluating each proposal's relative impacts.

There is an implicit tradeoff between the goals of reducing costs and improving environmental quality, although it is possible to promote both goals simultaneously. Increasing a firm's flexibility is not the only way to reduce costs, nor is tightening standards on every trade the only way to improve environmental quality. However, at some point, these goals inevitably will conflict. In designing a system where the actual effects of regulatory programs are uncertain and information about the various program elements is limited, this tradeoff should be viewed in probabilistic terms. Stated differently, the primary emphasis should be on the likely characteristics of typical emissions trading transactions rather than focus on extreme outcomes, whether good or bad, that could result.

Every proposed emissions trading system affects both costs and environmental quality. Industry usually advocates reforms aimed primarily at decreasing the costs of pollution control. These proposals generally involve expanding the scope for emissions trading by increasing the options available to firms for meeting environmental objectives. However, when efficiency gains result from giving firms greater flexibility in determining how to control their emissions, environmental quality may be adversely affected. In order to reduce emissions control costs without any sacrifice of environmental quality, some increase in regulatory expenditures may be required.

Environmentalists generally advocate reforms aimed primarily at improving environmental quality. Such proposals typically restrict the scope of emissions trading by decreasing a firm's flexibility. They often call for greater regulatory involvement in emissions trading while paying little attention to the potential for increased administrative and emissions control costs. Moreover, a focus on individual firms' emissions tends to obscure the global objectives of meeting ambient standards in a timely manner.

173. Suppose, for example, that the effects of a policy are measured in terms of their impact on costs and environmental quality. When measured in this way, one can then characterize the impact of this policy in terms of a probability distribution over costs and environmental quality.

174. Increased flexibility enables firms to use their knowledge about emissions control cost functions to find lower cost technologies for controlling emissions. An alternative is for regulators to increase their knowledge about firms' control cost functions and to design regulations in such a way that cost-effectiveness in emissions control will be increased. Aside from the fact that it is costly to obtain this information, efforts to obtain such information and use it to design cost-effective regulations have not been notably successful in the past. For a discussion of alternative approaches to obtaining more accurate cost information from firms, see Sonstelie & Portney, Truth or Consequences: Cost Revelation and Regulation, 2 J. POL'Y ANALYSIS & MGMT. 280, 280-84 (1982).
A. EPA's Final Emissions Trading Policy

The most significant elements of EPA's Final Emissions Trading Policy are:

1. Setting baselines for bubble transactions in nonattainment areas at the lower of allowable or actual emissions.\footnote{175}

2. Setting baselines in attainment areas at allowable emission levels, unless their use would threaten maintenance of air quality, in which case the baseline will be the lower of allowable or actual emissions.\footnote{176}

3. Revising the trading rule for bubbles in nonattainment areas so that an additional twenty percent reduction in emissions remaining after the transaction will be required from all trading sources. This applies to both internal and external trades.\footnote{177}

4. Allowing generic bubble rules in nonattainment areas provided that they produce additional reductions in emissions consistent with reaching attainment in the future.\footnote{178}

5. Increasing EPA oversight of state review of bubble applications under generic rules.\footnote{179}

6. Expediting review of pending bubble applications.\footnote{180}

This reform proposal substantially tightens the previous requirements for emissions trading, especially as they apply to nonattainment areas. By clarifying baselines for these areas, it reduces some of the uncertainty about the property rights to which firms may be entitled. However, the requirement that all sources involved in a bubble transaction in nonattainment areas reduce their remaining emissions by twenty percent imposes a substantial burden on firms and will cause a decline in bubble activity in nonattainment areas.\footnote{181} Advantageous use of a bubble under this provision will require a much wider difference in control costs


\footnote{176. Final Trading Policy, 51 Fed. Reg. 43,814, 43,816-18, 43,838-39 (1986). This element of EPA's Final Trading Policy has been significantly simplified for the convenience of readers who are unfamiliar with the intricacies of the Clean Air Act. This simplification parallels the distinctions made between areas by EPA in its Final Policy Statement. The "nonattainment areas" referred to in this section are only those areas for which state regulators have been unable either to meet air quality standards or to demonstrate to EPA's satisfaction that they have implementation plans in place which will enable them to meet air quality standards in the near future. "Attainment areas," in this section only, include (in addition to areas in compliance with air quality standards) areas currently in compliance with standards, but where EPA-approved implementation plans will lead to attainment in the near future.}


\footnote{181. This prediction of decreased trading activity also applies to generic bubbles and banking activity in these areas because these activities are subject to a similar reduction requirement. Final Trading Policy, 51 Fed. Reg. 43,814, 43,815, 43,831, 43,840 (1986).}
between the sources trading than under previous provisions because the required reduction in emissions for any trade will be at least twenty percent greater than under the previous bubble policy. The larger the sources involved, the larger will be the absolute amount of the twenty percent additional reduction required. Large sources are currently the primary users of bubbles because their cost savings justify going through the lengthy and expensive bubble process.182

Allowing the use of generic bubble rules in nonattainment areas is a positive step. Most bubble activity appears to take place in these areas, and generic rules result in more bubble activity than do rules requiring EPA approval. However, the fact that EPA intends to play a greater role in reviewing bubbles under generic rules works in the opposite direction, and could mean that approval for generic bubbles will be more difficult and time consuming. Thus, how EPA regions implement this element of the reform proposal will be crucial in determining whether generic bubble activity increases or decreases.

In attainment areas, the use of allowable emissions as a baseline for calculating emission credits will clarify uncertainty about a firm's property rights. Yet, most of the firms in these areas are presumably already in compliance or have already determined how to comply in the near future. Bubble activity in these areas is already at a low level,183 and in the absence of pending compliance deadlines or additional actions to encourage emissions trading, we predict that it is likely to remain so.

A major problem with the new EPA policy is that it reinforces the perception of a strong link between emissions trading and the achievement of air quality standards. This is especially apparent in the requirement for additional reductions for emissions trading in nonattainment areas. This requirement is at odds with the statement contained in the preamble to the policy that “[b]ubbles are simply alternative means of complying [with emission limits] at less cost. They should be treated neither more nor less stringently than other, more traditional methods of compliance.”184 Requiring large additional emission reductions from firms using emissions trading simply creates another disincentive for firms to use trading.185

183. See supra note 80.
185. Requiring marginally higher reductions is not necessarily a bad idea, however, since this may be a way to shift the probability distribution of the environmental effects of emissions trading toward the positive side without creating excessive incentives against the use of trading. One example is the use of offset rules that require offsets to equal the amount of a new source's emissions plus some
There are two unquestionably positive aspects of this policy from the viewpoint of encouraging emissions trading. The first is the directive that pending bubble applications be processed promptly, which may eliminate a substantial backlog of applications that have been languishing at various points in the EPA-review process for many months. If some of these applications are approved, other firms may be encouraged to apply, although the fact that compliance deadlines for most pollutants have passed may mean that most firms will have little incentive to use bubbles in the foreseeable future. The second positive aspect of this reform proposal is the statement that this policy “provides a permanent framework that will guide development of future bubbles and should make environmentally sound emissions trades more predictable and easy to obtain.” If this proves to be the case, much of the uncertainty about emissions trading that has resulted from frequent regulatory shifts will be eliminated. It cannot, however, resolve uncertainty due to promised court challenges by environmentalists.

Overall, EPA’s Final Emissions Trading Policy represents a conservative, cautious approach to the reform of emissions trading. Its emphasis is on preventing problem transactions rather than on increasing the level of trading. In areas experiencing difficulty complying with air quality standards, emissions trading is used to reduce emissions (through the use of the twenty percent additional reduction rule) rather than as a means to reduce emissions control costs. The new policy will reduce the probability of adverse environmental quality impacts from emissions trading. However, it will do so at the cost of reducing the level of trading and the economic gains from trading associated with federally-reviewed bubbles. In balancing the interests of environmentalists and industry, this reform
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seems to give considerably greater weight to the concerns of environmentalists.

B. An Alternative Approach to Emissions Trading Reform

One alternative reform that would reduce costs while promoting environmental quality is to reduce some of the uncertainties for firms engaging in emissions trading while, at the same time, improving the information necessary to calculate the baselines from which emission credits are determined. For example, improvements in data on actual emissions could simultaneously reduce some of the uncertainty for firms about their potential to create emission credits and decrease the probability that firms could use paper credits in emissions trading transactions. This type of reform might be seen as desirable by both industry and environmentalists for it would yield significant cost savings while maintaining environmental quality. Cost savings can be encouraged by increasing flexibility in meeting specific emissions standards, reducing uncertainties over the definition of property rights, and decreasing certain types of federal oversight to reduce transaction costs. Elements of this alternative proposal include:

1. Improving emission inventories so that allowable emissions could be used as the baseline for all emissions trading.

2. Enlarging significantly the scope of trading for new and modified sources. Firms would be allowed to use internal or external trading to meet all emission limits, and trades would be permitted only if they could be shown to result in no net emission increases beyond those allowed under current policy.

3. Encouraging states to develop generic bubble rules, and expediting approval of those rules at the federal level.

4. Developing a model banking program at the federal level, encouraging states to adopt it, and designing banking regulations that would encourage external trading. The regulations would require that all emission reductions being saved for future use by firms be deposited in formal

189. The presentation of this reform proposal should not be construed as an endorsement. Rather, it is an example of how the design of a proposal is contingent on its intended objectives. For a proposal for reforming emissions trading that takes the middle ground between EPA's and the one presented here, see R. LIROFF, supra note 23, at 135-44.

190. Note that the Clean Air Act does not allow new sources to avoid the “technology forcing standards” that apply to them. Despite the apparent inconsistency of this element with this provision of the statute, we feel that it is consistent with the overall goals of the Clean Air Act because the emission limits for new sources would be retained. This proposal would simply provide firms with flexibility in deciding how to meet those limits. A more detailed proposal would have to consider the anticipated useful lives of sources creating emission credits in order to preserve momentum toward improving air quality.
banks. In addition, the regulations would give banked emission rights the same status as rights that are currently in use.

The proposal to remedy information deficiencies for calculating emission credits would eliminate a major source of uncertainty about the probability of getting specific emissions trades approved.191 This would reduce a firm's incentives to trade internally. Improving emission inventories will require a massive effort by states, but the information gained would be of great value to regulators for meeting air quality goals regardless of whether emissions trading was used. Expanding the scope of emissions trading for new and modified sources would make emissions control requirements more neutral with regard to a firm's decision whether to construct a new industrial facility.192

Shifting primary control for bubble approval to the state level would reduce the time required to process applications and therefore reduce the uncertainty and transaction costs for firms. Developing a model banking program at the federal level would encourage the establishment of active, formal emission banks. These banks would significantly reduce transaction costs for emissions trading, especially search costs for firms that could benefit from external trades. Because only formally banked credits could be saved, informal banking would be effectively eliminated. The advantage of formal banks is that unlike informal banks, they function as a public source of information on credit availability. Granting banked rights equal status to rights currently in use would protect emission credits from confiscation, and would thus encourage greater firm participation in banking programs.193

While this proposal is structured primarily for the purpose of increasing cost savings from emissions trading, it is not intended to do so at the expense of environmental quality. More accurate emission inventories would surely be welcomed by environmentalists. The remaining elements of the proposal are intended, at a minimum, to maintain current levels of environmental quality. This proposal would not prevent regulators from requiring further emission reductions if environmental quality goals were not met. In fact, if active markets in emission credits were established,

191. See supra notes 48–53 and accompanying text (discussion of impact of uncertainty about baseline emissions quantities on emissions trading).

192. A distinction between new and existing sources would remain for firms engaged in netting because netting can result in small net increases in the level of emissions and external trading is not permitted. If external trading were allowed for netting, almost all firms wishing to build new or modified sources would use netting, since this would require that they purchase fewer emission credits. While this would result in higher cost savings for firms, environmental quality would be adversely affected. The proposal described here does not allow external trading for netting for this reason.

193. If reduction of all emission limits were necessary in an area, such a reduction should also affect banked credits. The proposal presented in this Article extends to banked rights the same treatment afforded rights already in use; it does not give banked rights preferential treatment.
regulators could reduce all permitted emission levels gradually over time, letting market forces determine where specific reductions should be made.

If a proposal like the one presented above cannot be adopted, a worthy alternative is to conduct a carefully monitored demonstration project. Such a project could be implemented on a small scale by a state regulatory agency. If these reforms are effective in limited geographic regions, they might change the attitudes of environmentalists and state regulators, most of whom have been reluctant to adopt emissions trading provisions. Only with support at the state level, where emissions trading can be effectively implemented or undermined, can the opportunity exist for improving emissions trading.

The foregoing analysis suggests the following three conclusions. First, the appropriate path for reform cannot be identified without specifying design objectives. Unfortunately, these objectives are frequently not stated, or not stated very clearly, in existing proposals. Second, it is possible to design reform proposals consistent with the Clean Air Act that both promote environmental quality and reduce expenditures on pollution control activities. Third, and perhaps most important, the nature of the political process is likely to shape and severely constrain the nature of reform proposals.

Conclusion

The emissions trading program has yielded a mixed bag of successes and failures. The activity given the most attention—EPA-approved bubbles—has been the least used. Nevertheless, the cost savings from emissions trading have been impressive, amounting to over a billion dollars. Netting and offsets have been the most successful aspects of the program, having been used by thousands of firms. Banking has been the least used emissions trading activity. As a result, potential buyers and sellers have not been brought together. In fact, the general failure of active markets in emission reduction credits to develop is the greatest disappointment of emissions trading. Until such markets exist, the full potential of emissions trading to reduce pollution control costs will go unrealized.

The aggregate environmental effects of emissions trading appear to have been negligible, although further information is necessary to determine the precise effects of netting and offsets on the environment. A critical factor in assessing environmental performance is the baseline used for determining permissible trades. If the baseline involves a large amount of permitted emissions that are not actually produced, then the potential for an adverse environmental impact is significant; if the baseline reflects a
realistic assessment of actual emissions, then the potential for environmental harm is slight.

Thus, the results of our analysis show that the emissions trading policy is worthwhile. A reform was implemented that resulted in significant cost savings without adversely affecting aggregate environmental quality. Given this outcome, it is important to consider why the program has been so controversial. The answer emerges only after dissecting the interests of the various groups that shaped the program.

Environmentalists and industry both have strong interests in achieving their respective policy goals and regulators try to balance what are often competing interests. The interaction of these three groups has given rise to the current emissions trading policy. The basic controversy over emissions trading can be understood in terms of a struggle over property rights. Environmentalists and industry fundamentally disagree on who is entitled to benefit from the property rights created by emissions trading and how these rights can be used. Because of this disagreement, EPA has tried to structure its policies in such a way as to reduce conflicts between these interest groups. This observation explains much about the evolution of the program because it accounts for the language developed by EPA that attempts to minimize the appearance that industry had been given a nego-
tiable property right. The resulting uncertainty about the status of emission reduction credits has led industry to use internal rather than external trades.

While a discussion about property rights is instructive, it fails to account for another interesting feature of emissions trading. The performance of each of the emissions trading programs, when measured by its activity levels, exhibits dramatic differences. At least part of this variation is attributable to the differing levels of federal involvement. Other things being equal, state regulators will prefer to implement programs over which they have greater control. This straightforward observation accurately explains the relative performance of different elements of emissions trading. Moreover, it explains some of the innovations made by state regulators, such as informal banking.

The fact that state-controlled emissions trading programs have been more active does not imply that federal involvement in emissions trading or increased federal oversight is unwarranted. Rather, it emphasizes the importance of examining the relationship between federal, state, and local authorities in understanding emissions trading activities. Indeed, intergovernmental relations can explain a wide array of environmental policies, ranging from monitoring and enforcement to standard-setting. Further research in this area will probably be useful in constructing a theory that accounts for differences in implementation.
Emissions Trading

The experience in emissions trading sheds light on the capacity of government to design more flexible approaches to environmental regulation. The performance of this program reveals that reform is likely to follow a tortuous path when interest groups pursue divergent policies. However, all efforts to implement more flexible approaches for addressing environmental problems need not be tangled in red tape. Such programs are less likely to get bogged down when there is a greater consensus about the nature and goals of the program. Indeed, EPA's program to promote lead trading among gasoline refiners provides an interesting contrast to the emissions trading program. Unlike emissions trading, the lead trading program appears to have created a smoothly functioning market for lead rights. 194

A final lesson to be drawn from the preceding analysis is that a study of only part of a program can be misleading. Focusing on the entire array of emissions trading activities not only sheds light on the overall performance of the program, but also leads to the development of a paradigm that is useful in understanding the choice and implementation of regulatory instruments. Currently, no theory of instrument choice that includes implementation issues is widely accepted. 195 Such a theory can be built inductively through careful analysis of the political economy of regulatory reform.

194 For a comparison of the emissions trading and lead trading programs, see Hahn & Hester, Marketable Permits: Lessons for Theory and Practice, ECOLOGY L.Q. (forthcoming).