The Design of an Emissions Permit Market for RECLAIM: A Holistic Approach

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I.
INTRODUCTION

Economists have long recognized that environmental pollution produces externalities that obstruct the mechanics of an efficient market system.[1] On the other hand, some commentators point to environmental regulations as a source of economic stagnation.[2] Thus, many have concluded that translating public goods like air and water quality into marketable goods will eliminate these market inefficiencies. Beginning in the 1970s, environmental policy analysts began to incorporate these economic principles into the development of environmental policy.[3]

The 1990 Clean Air Act Amendments[4] provide for the consideration of market-based incentives in the design of air pollution control programs.[5] In 1992, the South Coast Air Quality Management District (SCAQMD or "the District") adopted the Regional Clean Air Incentives Market (RECLAIM), a transferable discharge permit

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1. *See, e.g.*, Harold Wolozin, *The Economics of Air Pollution: Central Problems*, 35 LAW & CONTEMP. PROBS. 227, 233 (1968).

2. *See, e.g.*, Bruce A. Ackerman & Richard B. Stewart, *Reforming Environmental Law*, 37 STAN. L. REV. 1333, 1334-35 (1985). Regardless of the veracity of this contention, few would dispute the benefits of more efficient environmental regulation.

3. *See* Daniel J. Dudek & John Palmisano, *Emissions Trading: Why Is This Thoroughbred Hobbled?*, 13 COLUM. J. ENVTL. L. 217 (1988); *see generally* BUYING A BETTER ENVIRONMENT (Ehrhard F. Goeres & Martin H. David eds., 1983) [hereinafter BUYING].

4. Pub. L. No. 101-549, 104 Stat. 2399 (codified in scattered sections of 42 U.S.C. §§ 7401-7671 (Supp. III 1991)).

5. Clean Air Act, 42 U.S.C.A. §§ 7651-7651o (West Supp. 1991).

program designed to control nitrogen oxide (NO_x), reactive organic gas (ROG), and sulphur oxide (SO_x) emissions in the Los Angeles Basin.[6] Economic modeling suggests that under the conditions of a perfectly competitive market,[7] such programs can dramatically improve the efficiency[8] and cost effectiveness of pollution control. This kind of program allocates emission control to those who can accomplish it most cheaply, thus reducing the economic hardships that environmental regulation imposes on industry. The promise of low-cost pollution control in times of economic privation appeals to industry and policy-makers alike.

In order to achieve the cost savings suggested by the economic model, RECLAIM must forge a marriage between economic theory and reality. RECLAIM's success hinges upon the development of the most perfect market attainable while minimizing negative side effects such as unemployment and inequity. This Comment focuses on the decisions that SCAQMD faces in designing an effective market that achieves the promised efficiency of the economic model. I address the selection of appropriate systems and trading markets with respect to their potential for market manipulation and liquidity,[9] and with an eye towards minimizing the administrative burden

6. *See Air Board Approves Most of South Coast Plan, Including New Local Emission Trading Program*, 23 Env't Rep. (BNA) 1650 (Oct. 23, 1992); *South Coast Emissions Trading Proposals Criticized by Industry, Environmentalists*, 23 Env't Rep. (BNA) 1752 (Nov. 13, 1992); Maria L. LaGanga, *Pollution Trading Program Outlined*, L.A. TIMES, Nov. 5, 1992, at B1.

7. While the existing literature does focus on many of the important aspects of the design of emissions trading programs, *see* Wayland J. Eheart et al., *Transferable Discharge Permits for Control of BOD: An Overview*, *in* BUYING, *supra* note 3, at 163-95; Ackerman & Stewart, *supra* note 2; Dudek & Palmisano, *supra* note 3; Robert W. Hahn & Gordon L. Hester, *Where Did All the Markets Go? An Analysis of EPA's Emissions Trading Program*, 6 YALE J. ON REG. 109 (1989), it contains many holes and deficiencies. The heart of the problem is that the academic literature deals almost exclusively with program design under the assumptions of a perfect market, even though perfect market conditions are very unlikely to exist in practice. Many of the choices involved in designing an emissions trading market will require trade-offs that will compromise the market, thus making it more "imperfect," and these imperfections should be taken into account in the planning process. T.H. TIETENBERG, EMISSIONS TRADING: AN EXERCISE IN REFORMING POLLUTION POLICY 50-52 (1985) [hereinafter EMISSIONS TRADING].

8. Efficiency is the cost of accessing the market, successfully completing a transaction, and responding to new information. SCAQMD, REGIONAL CLEAN AIR INCENTIVES MARKET (RECLAIM) SUMMARY RECOMMENDATIONS 4-11 (Spring 1992) [hereinafter RECLAIM SUMMARY RECOMMENDATIONS].

9. Liquidity is "the ability of the buyer or seller to complete a trade quickly and at a price similar to previous transactions. The depth of trading activity, especially the volume, or number, of bids and offers in a wide range surrounding the prevailing price is also an important element of liquidity." *Id.*

of SCAQMD. Additionally, I probe the options available for minimizing the dispersive effects of air pollutants that could result in nonattainment of standards in specific locales as a result of the trading of emissions permits.

The choice of an appropriate market structure is inextricably linked to choices concerning baseline allocation and the methods of addressing the spatial dimension of the market. Because many of these choices will likely involve trade-offs with the efficiency of the market itself, the attainment of perfect market conditions is extremely unlikely. These market imperfections have critical implications for the choice of an appropriate market structure and baseline allocation scheme. Intertwined with these considerations are issues concerning the development of market power and the spatial distribution of emissions permits. This Comment addresses these issues as they pertain to the RECLAIM program and other emissions trading programs that may develop in the future.

While this Comment focuses on market structures that maximize efficiency and cost effectiveness, many other criteria — such as equity, impacts on employment, feasibility, enforceability, and legal authority — are also important to RECLAIM's success. These criteria deserve intense study and evaluation in their own right. However, I address them only as they pertain to the development of an effective market structure. The selection of a particular market structure inevitably involves trade-offs among these various criteria, and this Comment attempts to delineate the nature and magnitude of these trade-offs.

The many aspects of an emissions trading program cannot be analyzed in isolation because their interrelated nature requires a holistic approach. This Comment attempts to identify these linkages and develop a cohesive emissions trading regime that is prepared to work under the imperfect conditions that such a program will inevitably face.

Because RECLAIM has generated widespread interest as a pilot program for future emissions trading programs, the issues this Comment addresses may eventually have national, or even international, applicability. Although these subjects will be discussed in the specific context of RECLAIM, most of the same decisions will also confront designers of other emissions trading programs in the future.

II.
MARKET BASED TRADING SCHEMES VERSUS COMMAND AND CONTROL REGULATION

The basic design of an emissions trading program[10] is relatively simple. The control authority determines the aggregate emissions level necessary to achieve ambient air quality standards for a specific class of pollutant. A number of emissions permits corresponding to this allowable emissions level is distributed among sources in the control region, and sources are allowed to trade these permits freely among themselves. Those sources whose emissions are very expensive to control will purchase permits from sources that can control their emissions more cheaply. The trading price will generally be somewhere between the marginal control costs of the buyer and seller, and therefore, both sources have an incentive to consummate the trade. Under perfect market conditions such a system will distribute permits to cover emissions that are the most expensive to reduce. Emissions that can be reduced at a lower cost will not be covered by permits and therefore must be eliminated. The final result is the least-cost allocation of control responsibility among sources.

This type of program differs dramatically from the existing "com-

10. The formal development of the emissions trading approach began with the work of Baumol and Oates in 1971, *see* Scott E. Atkinson & T.H. Tietenberg, *The Empirical Properties of Two Classes of Designs for Transferable Discharge Permit Markets*, 21 J. ENVTL. ECON. & MGMT. 101 (1982), and was soon followed in 1972 by an article by Montgomery on the properties of two alternative forms of marketable permit systems, W.D. Montgomery, *Markets in Licenses and Efficient Pollution Control Programs*, 5 J. ECON. THEORY 395 (1972). Since then, well over 100 articles endorsing these market-based approaches have been published. *See* Dudek & Palmisano, *supra* note 3, at 218.

While emissions trading has not been used extensively in practice, *see* Atkinson & Tietenberg, *supra*, there have been a few examples of emissions trading in action, *see, e.g.*, Dudek & Palmisano, *supra* note 3, at 223-29 (discussing the use of offsets, netting, and bubbles in the U.S. Clean Air Act). An extensive literature focuses on the programs and why they have not worked as well as expected. *See* EMISSIONS TRADING, *supra* note 7 (analyzing the EPA Emissions Trading Program within the context of each chapter and including an evaluation and proposals for further reform in its final chapter); Scott Atkinson & Tom Tietenberg, *Market Failure in Incentive Based Regulation: The Case of Emissions Trading*, 21 J. ENVTL. ECON. & MGMT. 18 (1991) [hereinafter Atkinson & Tietenberg, *Market Failure*] (identifying the sequential and bilateral nature of these trading programs as the chief cause of their underachievement); Dudek & Palmisano, *supra* (analyzing some of these programs and the problems that need to be worked out in order to achieve maximum efficiency); Eheart, *supra* note 7 (providing an overview of the many trade-offs and choices involved in designing a transferable discharge permit program for the control of BOD in water bodies); Hahn & Hester, *supra* note 7 (examining trading patterns and trends in EPA's bubble, offset, netting and banking programs).

mand and control" approach in which the control authority dictates specific control technologies.[11] Command and control approaches ignore variations among sources[12] and tend to force them to use the most expensive control technologies even when such drastic measures are not necessary or cost effective for most sources.[13] Emissions trading recognizes the variability among sources and allows each source either to control emissions by any method it deems appropriate or to purchase permits in the marketplace. Because the control authority predetermines the total number of permits, aggregate emissions will not exceed the level the control authority sets.

Computer modeling and experience with the EPA's limited Emissions Trading Program suggest that cost savings can be dramatic. The South Coast Air Quality Management District has projected cost savings from RECLAIM to be approximately 425 million dollars in 1994 and 270 million dollars in 1997 when compared to the command and control approach of the Air Quality Management Plan (AQMP).[14] This represents savings of 71% and 35% over the AQMP in 1994 and 1997 respectively.[15] In a survey of eight studies estimating cost savings from emissions trading programs, six studies found very large potential savings in abatement costs.[16] The studies predicted cost savings ranging from 78% to 2200% lower than command and control costs.[17] Cost savings under the limited EPA Emissions Trading Program have been estimated conservatively at 25 million dollars due to offsetting, 650 million dollars under the bubble program,[18] and between 500 million and 12 billion dollars for netting transactions,[19] despite the well documented weaknesses and deficiencies of this particular program.[20]

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11. EMISSIONS TRADING, *supra* note 7, at 15. *See generally* Ackerman & Stewart, *supra* note 2 (comparing existing technology-based command and control systems with market-based trading schemes).

12. *See* Ackerman & Stewart, *supra* note 2, at 1335.

13. *Id.* at 1337-39.

14. RECLAIM SUMMARY RECOMMENDATIONS, *supra* note 8, at H-3 (table H-1).

15. *Id.* at H-4 (table H-2).

16. EMISSIONS TRADING, *supra* note 7, at 41-44. The two studies that did not show significant cost savings can be explained by the unusual conditions of the specific areas or programs analyzed. *Id.*

17. *Id.* at 44.

18. A bubble program refers to a "provision that allows 'swaps' of emissions of a particular pollutant within plants, across plants and even across firms, provided pollution is not made worse." BUYING, *supra* note 3, at 268.

19. "Netting allows sources undergoing modification or expansion to escape the burden of new source review requirements so long as any net increase . . . in plantwide emissions is insignificant." EMISSIONS TRADING, *supra* note 7, at 8.

20. Dudek & Palmisano, *supra* note 3, at 233.

III.
BASELINE ALLOCATION OF PERMITS

The initial allocation of permits in RECLAIM is a politically-charged issue that resonates with questions of equity, feasibility, liquidity, and the potential for manipulation of the ensuing market.[21] Permit allocations can be determined from a variety of different mechanisms, each of which is accompanied by a set of attributes respecting these criteria. Essentially all of the suggested allocation schemes fall into one of two broad groups: "grandfathering" and "auction" mechanisms. "Grandfathering" determines the initial distribution of permits by a formula based on each sources's past emissions,[22] whereas an "auction" involves competitive bidding for the limited number of permits.

A. *Choosing an Allocation Scheme*

The selection of an initial allocation scheme will require SCAQMD to make a series of choices aimed at fulfilling a number of objectives. SCAQMD must decide whether the allocation procedure should yield revenue for the agency. While a revenue-generating mechanism would help fund the administration and enforcement of RECLAIM, it would involve a trade-off with higher overall control costs for the regulated industries. Similarly, SCAQMD must determine the extent of its own involvement in the

21. Mechanisms for determining the initial allocation of permits, also called baseline allocations, have been addressed in a number of scholarly articles. *See* Randolph M. Lyon, *Equilibrium Properties of Auctions and Alternative Procedures for Allocating Transferable Permits*, 13 J. ENVTL. ECON. & MGMT. 129 (1986) (analyzing three different baseline allocation procedures — incentive compatible auctions, transfer-neutral auctions, and grandfathering — he concludes that under perfect market conditions these mechanisms are essentially equivalent); Robert W. Hahn, *Designing Markets in Transferable Property Rights: A Practitioner's Guide*, *in* BUYING, *supra* note 3, at 83 (reporting experimental findings using one form of transfer-neutral auction); Timothy H. Quinn, *Distributive Consequences and Political Concerns: On the Design of Feasible Market Mechanisms for Environmental Control*, *in* BUYING, *supra* note 3, at 39 (analyzing baseline allocation procedures and their potential for compensation to satisfy the Pareto Superiority criterion); Scott R. Milliman & Raymond Prince, *Firm Incentives to Adopt New Pollution Abatement Technology*, 17 J. ENVTL. ECON. & MGMT. 247 (1989) (comparing auctioned permits and freely distributed permits, as well as other forms of incentive-based programs, with respect to their potential to promote firm incentives for technological innovation); Ackerman & Stewart, *supra* note 2, at 1360-64 (recommending a revenue-raising auction in order to raise public funds and to provide administrative agencies with incentives to rigorously enforce the program); EMISSIONS TRADING, *supra* note 7, at 93-124 (chapter five reviews revenue auctions, subsidies, grandfathering and zero-revenue auctions (transfer-neutral) without explicitly endorsing any of these approaches).

22. *See* BUYING, *supra* note 3, at 268.

information processing that will be inevitably linked to the system of allocating the permits. In general, grandfathering schemes require a more active role on the part of the air quality management district (AQMD), because it must gather and process a great deal of information on past emissions or activity levels. Auctions also require AQMD administration, but the process is more straightforward and involves fewer political considerations.[23]

The initial permit allocation procedure should promote trading and maximize liquidity by establishing a clear price signal. The scarcity of trading in previous permit trading programs can be traced to a number of factors,[24] with the absence of a price signal chief among them.[25] This has led to a great deal of uncertainty about the value or reasonable price of a permit, which results in a lack of information in the market.[26] Consequently, transaction costs rise and market liquidity is reduced. This is one of the reasons why more trades tend to occur within individual sources than between sources.[27]

Clearly, one of the principal objectives of the market is to approximate over time the least-cost solution.[28] The chief superiority of tradeable permit systems over command and control mechanisms lies in their ability to achieve a least-cost allocation of pollution control burdens.[29] However, certain initial allocation procedures may impede the attainment of this least-cost solution, largely because they may promote a market that is vulnerable to manipulation. If one or a group of sources receives many more permits in the initial allocation than it would hold in the equilibrium situation, it may have the potential to manipulate the market price for permits.[30] Alternatively, certain initial allocation procedures may promote a market with high transaction costs and decreased liquidity.[31]

Another objective in choosing an initial allocation procedure is to seek an allocation in which the equilibrium, low-cost solution is achieved rapidly.[32] Auctions tend to lead immediately to the low-

23. *See* Lyon, *supra* note 21, at 129-30.

24. *See* U.S. General Accounting Office, *A Market Approach to Air Pollution Control Could Reduce Compliance Costs Without Jeopardizing Clean Air Goals*, PAD-82-15, March 23, 1982.

25. Hahn, *supra* note 21, at 86.

26. *Id.*

27. *Id.*

28. *See id.* at 86-87.

29. *See, e.g.*, Ackerman & Stewart, *supra* note 2, at 1342 n.19.

30. *See, e.g., id.* at 1351.

31. *See, e.g.*, Hahn & Hester, *supra* note 7, at 140.

32. Hahn, *supra* note 21, at 87.

cost solution, because, in essence, the auction mimics a full trading scenario. Conversely, grandfathering results in a time lag before the least-cost allocation is met.

The choice of an initial allocation procedure should also consider the equitable consequences of the procedure.[33] To the greatest degree possible, a tradeable permit program should evenly distribute the benefits among sources and even among the public. The design of an initial allocation scheme should consider impacts on employment, as well as the potential impacts on output markets. It is in the determination of winners and losers that the initial allocation plays its greatest role, and for this reason it is a politically-charged decision.

B. *Grandfathering Schemes*

Grandfathering schemes determine baseline allocations from past emissions or activity levels — and perhaps some other considerations — and then distribute the permits among existing sources.[34] The permits may be given away free in order to minimize the overall control costs. However, it is possible to charge a nominal fee for the permits if it is low enough so as not to alter the demand for the permits. The price should be set at the level at which the trade-off between AQMD revenue and slightly elevated control costs is deemed most acceptable.

Following the baseline allocation, permits are traded in order to achieve the low-cost equilibrium distribution. If the market is competitive, efficiency is achieved. Grandfathering followed by trading achieves the same market clearing price as that arising from an incentive-compatible auction that automatically allocates permits to those firms that most value them.[35] If the market clearing price from grandfathering is greater than that derived from an incentive-compatible auction, then some sources will own permits with values below the market clearing price. These sources would then sell these permits in the market, which would lower the market clearing price until it reached the efficient price. Similarly, where the market price is below the efficient price, it would be driven up to the efficient price in a competitive market.[36]

Grandfathering has an advantage over traditional auction

33. *See id.*

34. *See* Hahn & Hester, *supra* note 7, at 113 n.28.

35. Lyon, *supra* note 21, at 143-44. *See* discussion *infra* part III.C.2 regarding incentive-incompatible auctions.

36. Lyon, *supra* note 21, at 144.

schemes because it makes the permits well-defined property rights and does so without incurring significant transfer costs. Perhaps the greatest benefit of a grandfathering scheme is that it provides SCAQMD with flexibility to satisfy equity concerns. When baseline allocations are based upon past emissions or past activity levels the trading market will tend to perpetuate the status quo in its selection of winners and losers.[37]

Unfortunately, grandfathering schemes also possess some negative attributes. The efficiency of the market relies upon the conditions of perfect competition which, by definition, suggests no market manipulation. However, grandfathering is vulnerable to manipulation because the sources have an incentive to misrepresent their past emissions in order to gain more initial permits and market power. If a source with market power does not obtain permits equal to the number that it would hold in equilibrium, then the total abatement costs will exceed the least-cost solution.[38] This inefficiency arises whether that source receives more or fewer permits than it would hold in equilibrium.[39] Additionally, in a grandfathering scheme an early price signal is not given, which leads to incomplete information and an imperfect market where efficiency is often not achieved or is achieved only after a significant time delay.

C. *Auction Mechanisms*

Auction mechanisms provide an alternative to grandfathering that reduces some of the political aspects of baseline allocation by allowing competitive bidding for a predetermined number of permits. Most likely, an auction would be conducted by requiring firms to provide SCAQMD with purchase schedules that include permit requests at various price levels.

1. Single-Price Auctions

In a single-price auction, identical permits are sold by the government at a single market clearing price that would be determined by either the lowest accepted bid or the highest rejected bid. Sources would submit their demand curves to SCAQMD, which then would distribute permits to those firms with the greatest demand for them — but all at the same price. Unlike grandfathering, a single-price auction would involve substantial transfer payments by sources to

37. *Id.*

38. *See* Robert W. Hahn, *Market Power and Transferable Property Rights*, Q.J. ECON., Nov. 1984, at 756-57.

39. *Id.* at 756.

SCAQMD.[40]

The advantages of a single-price auction cover many of the areas where grandfathering is deficient. A single-price auction is more equitable because everyone pays the same price for permits — although some sources with fewer resources would be unable to obtain permits in competition with larger sources. In addition, efficient allocation is achieved immediately and an early price signal is provided to sources in the market. The fact that efficiency is so quickly attained mitigates the impacts that market power can have on the cost of compliance. Nevertheless, some potential for manipulation does exist because the single-price characteristic does not bind sources to pay in accordance with their true demand curves. If a source could predict where the permit price would be set, it could misrepresent its demand curve so as to receive more permits; sources could use this strategy to manipulate the market and disrupt its efficiency.

2. Incentive-Compatible Auctions

If circumstances suggest that manipulation is a significant concern, market manipulation can be avoided through the institution of an incentive-compatible auction. Incentive compatibility refers to the characteristic of the mechanism that encourages participants to reveal their demand curves for permits. Without collusion, the sources' best strategy is to supply truthful information.[41] In an incentive-compatible auction, permits are allocated to the highest bidder, who pays a different price for each permit it buys. SCAQMD would set the price for each permit at the highest rejected bid below that source's bid. Such a system makes the source accountable for its own bids and deprives it of any incentive to misrepresent its demand.[42]

Incentive-compatible auctions essentially eliminate concerns about market manipulation during baseline allocation, and they succeed in providing a price signal. Market equilibrium arises immediately and an efficient result is quickly achieved. Unfortunately, as with a single-price auction, the high transfer payments make overall costs prohibitively high, and smaller sources are forced to compete with larger sources whose resources confer a significant advantage in the auction. Similarly, the fact that identical permits are priced differently for different sources arguably is intuitively

40. *See* Eheart, *supra* note 7, at 169.
41. *Id.* at 189.
42. *See* Lyon, *supra* note 21, at 135-36.

inequitable.[43]

3. Transfer-Neutral Auction

The high transfer payments of single-price or incentive compatible auction schemes raise overall costs to such a degree that the cost savings of a permit trading market are largely lost. Transfer-neutral auctions solve this problem by redistributing the transfer payments to the auction participants. Such a system eliminates transfer costs and satisfies the criterion of Pareto efficiency.[44]

In many ways, transfer-neutral auctions combine the benefits of grandfathering and auction mechanisms while eliminating most of their disadvantages. The auction procedure quickly gives rise to efficient permit distribution, and a price signal is given immediately. There are no transfer payments, and smaller sources are compensated if they are unable to compete equally in the auction. Depending upon the redistribution formula used, the potential for equity is high. If designed properly, such procedures can largely eliminate market manipulation, although it is unlikely that they could be truly incentive compatible.

Lyon asserts the following proposition:

> As the number of participants in the two procedures increases, the efficiency, distributional, and incentive-compatible properties of an incentive-compatibility auction followed by lump-sum refunds approach those of a competitive market following initial lump-sum distribution of permits, as long as both approaches use the same formula to make their lump-sum distribution to participants.[45]

This proposition suggests that if a transfer-neutral auction redistributes revenues according to the same formula as a grandfathering scheme, the resultant markets and compensation under the two approaches will be virtually identical. This is only the case if the grandfathering scheme is followed by a competitive market. However, there are difficulties in achieving a competitive market following a grandfathering scheme, as explained in Part III.B. For this reason, and the fact that a transfer-neutral auction reaches equilibrium much more rapidly than a grandfathering scheme, even with perfect competition, a transfer-neutral auction is a very attractive alternative.

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43. *See* Eheart, *supra* note 7, at 170.

44. "An allocation of resources is Pareto optimal, or Pareto efficient, when every other allocation that makes one agent better off necessarily makes at least one other agent worse off." BUYING, *supra* note 3, at 269.

45. Lyon, *supra* note 21, at 143.

Atkinson and Tietenberg's "trading process hypothesis" explains why EPA's Emissions Trading Program has not achieved the cost savings that were initially projected.[46] It suggests that under the bubble program,[47] the trading process is sequential and bilateral rather than simultaneous and multilateral as assumed in the existing empirical studies.[48] One result of the bilateral, sequential trading pattern is that suboptimal trades are often made, because the absence of good information on future market opportunities causes firms to make trades that later prove to be unwise.[49] For non-uniformly mixed pollutants, simultaneous trading by all firms is necessary to reach a cost-effective equilibrium.[50]

By contrast, a transfer-neutral auction provides a multilateral and simultaneous trading scenario in which all sources are brought together and suboptimal trades do not occur. A permit trading regime punctuated by a series of such auctions at four- to five-year intervals would minimize the problems elucidated by Atkinson and Tietenberg. Under such a system, permits could have a four- or five-year lifespan, corresponding to the period between auctions, during which the source that purchased the permit would hold the principal property right. The source would be able to trade away the right to use the permit for a specified time during the four- or five-year period — but not the actual property right. At the end of the permit's lifespan, a new auction would be held and the process would be repeated. Such a system would repeatedly restore the market to equilibrium, and the transfer-neutral auction redistribution system could be used to monitor sources' behavior and to provide positive incentives for pollution-reducing behavior.

Despite the many advantages of a transfer-neutral auction, SCAQMD has given this option very little attention and will almost certainly use a grandfathering scheme for the initial distribution of permits. This may be attributable to possible concerns over the political feasibility of a transfer-neutral auction. Many businesses may find such a mechanism difficult to understand, and they may not realize that the final results of the two approaches are the same. However, since SCAQMD has said nothing about transfer-neutral

46. *See* Atkinson & Tietenberg, *Market Failure*, *supra* note 10, at 18.

47. *See supra* note 18.

48. *See* Atkinson & Tietenberg, *Market Failure*, *supra* note 10, at 19.

49. Atkinson and Tietenberg established that "[s]equencing can have a drastic effect on the total potential cost savings that can be achieved. This problem is particularly acute in the emissions trading market because of the lumpiness of the pollution control investments and the thinness of the markets." *Id.* at 29.

50. *See id.* at 18-19.

auctions, it is impossible to know what kind of response such a mechanism would elicit from the business community.

A transfer-neutral auction provides great flexibility in its design specifications. One possible system involves the allocation of free permits via a grandfathering system.[51] All sources would then put up all of their permits for sale in an auction in which the control authority would collect bids and determine a single price. Permits would then be reallocated, sources would be compensated for permits sold from their initial allocation, and they would pay for any additional permits they needed.[52] This Comment proposes in Part V a different form of transfer-neutral auction in which the redistribution of the auction revenues is determined according to a "point" system.

IV.
THE TRADING MARKET

A. *Geographical Restrictions on Transfers*

When attempting to implement air pollution control policy, one must be conscious of the fact that the extent and distribution of environmental damage depend not only on aggregate emissions levels but also on the spatial distribution of sources and dispersion characteristics of the pollutants.[53] With these geographical and at-

51. EMISSIONS TRADING, *supra* note 7, at 101-02 (calling transfer-neutral auctions "zero-revenue" auctions).

52. *Id.* at 101.

53. The spatial dimension of emissions trading has been thoroughly addressed in the literature. *See* Albert Lefties, *A Comparison of Two Discharge Permit Systems*, 15 J. ENVTL. ECON. & MGMT. 35 (1988) (noting that W.D. Montgomery's work laid the foundation for discussion of two different approaches: ambient permit systems (APS) and emissions permit systems (EPS)); *see also* Alan J. Krupnick et al., *On Marketable Air Pollution Permits: The Case for a System of Pollution Offsets*, *in* BUYING, *supra* note 3, at 6 (suggesting that Montgomery's condition that an APS program require strict non-degradation at all receptor points is unnecessarily restrictive and that trades should be allowed as long as no violation of standards occurs at any receptor point, and developing the framework for a pollution offsets system (POS) that has lower transaction costs and minimizes abatement costs irrespective of the initial distribution of permits); Scott A. Atkinson & Donald H. Lewis, *A Cost Effective Analysis of Alternative Air Quality Control Strategies*, 1 J. ENVTL. ECON. & MGMT. 237, 238 (1974) (reviewing the APS and EPS approaches and concluding that an ambient permit system with multiple simultaneous markets would produce a least-cost equilibrium and would prevent "hot spots" from developing); Scott A. Atkinson & T.H. Tietenberg, *The Empirical Properties of Two Classes of Designs for Transferable Discharge Permit Markets*, 9 J. ENVTL. ECON. & MGMT. 101, 104 (1982) (reviewing these permit designs and searching for new designs that minimize the drawbacks of these two approaches); Robert W. Hahn, *Trade-Offs in Designing Markets and Multiple Objectives*, 13 J. ENVTL. ECON. & MGMT. 1 (1986) (comparing APS, EPS and POS designs and noting trade-offs, advan-

mospheric factors in mind, there are a number of ways in which this spatial dimension can be managed within the framework of RECLAIM.

The level of air quality degradation allowed at various locations within an airshed can profoundly influence the cost-effectiveness of the program. The permitted degradation level can be set at the National Ambient Air Quality Standard (NAAQS),[54] strict nondegradation, or some level in between, as with the "increments"[55] of the Clean Air Act's Prevention of Significant Deterioration (PSD) regulations.[56] A substantial portion of the monetary savings from emissions trading may be attributable to increased emissions in those parts of the region where air quality is better than the national standard.[57] Policy makers are then confronted with a trade-off between decreased air quality and increased abatement costs that theoretically would be decided by a comparison of marginal abatement costs and marginal damage. Unfortunately, the difficulty of making such calculations and the questionable legality of such considerations under the Clean Air Act thrusts this trade-off decision into the hands of the designers of the emissions trading program.[58]

The RECLAIM Summary Recommendations[59] address the issue of trade preapproval. Such a mechanism could be used to ensure that a trade of emissions from one area to another would not result in noncompliance with PSD regulations in the vicinity of the buyer's operations. The unrestricted trade of permits potentially could result in a disproportionate accumulation of permits and emissions in a localized portion of the South Coast Air Quality Management District. Requiring ad hoc approvals of transactions could avert such a scenario.[60] Unfortunately, the administrative

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tages and disadvantages of each one); Lefties, *supra*, at 37-38 (focusing specifically on the APS, EPS, and POS designs under conditions of imperfect competition as would likely exist in practice).

54. Clean Air Act, 42 U.S.C. § 7410 (1988 & Supp. III 1991).

55. *Id.* § 7473 (1988).

56. *Id.* §§ 7470-7492; *see also Alabama Power Co. v. Costle*, 636 F.2d 323 (D.C. Cir. 1979).

57. Albert M. Lefties & Wallace E. Oates, *Marketable Permits for the Prevention of Significant Deterioration*, 12 J. ENVTL. ECON. & MGMT. 207, 210 (1985).

58. The Clean Air Act forbids the significant deterioration of air quality in areas where the air is cleaner than required by air quality standards. *See generally* N. William Hines, *A Decade of Nondegradation Policy in Congress and the Courts: The Erratic Pursuit of Clean Air and Water*, 62 IOWA L. REV. 643 (1977).

59. RECLAIM SUMMARY RECOMMENDATIONS, *supra* note 8.

60. *See* Eheart, *supra* note 7, at 173.

burden of such a system would likely result in a stagnant trading market and a "logjam" of administration at SCAQMD. The Summary Recommendations recognize this problem and conclude that the sale of emissions should not be constrained by requiring SCAQMD to preapprove emissions reductions, but rather emissions sales should be subject to post-transfer approval via audits and tracking.[61] In its March 1992 Feasibility Study Summary, included in the RECLAIM Summary Recommendations, the Regulatory Flexibility Group suggested that SCAQMD monitor trading patterns and restrict trading only if permits begin to accumulate disproportionately in certain parts of the District.[62] This minimizes market restrictions that disrupt market efficiency, because restrictions would only apply if a problem actually appeared. Similarly, administrative costs would almost certainly be lower than with a preapproval requirement.

Alternatively, the District may be divided into subzones with trading restricted to sources within the same zone.[63] While this would prevent regional accumulation of permits, it would significantly reduce trading and restrict market efficiency. Substantial cost savings from trading would be lost because of the limited trading area and small universe of sources. Additionally, the small markets would be vulnerable to market manipulation and exclusionary hoarding of permits.[64]

An Ambient Permit System (APS) is one solution to the "small market" problems associated with a zoned market approach. Under an APS, SQAQMD would issue a series of separate permits for each of several receptor points; the number of permits issued at each point would equal the air quality restraint at that site.[65] In effect, several markets would operate simultaneously and each source would purchase permits in each of the markets where its emissions affected the receptor.

Unfortunately, an APS program would create tremendous information burdens and administrative complexity. Because of the

61. RECLAIM SUMMARY RECOMMENDATIONS, *supra* note 8, at EX-11.

62. *Id.* at E-23.

63. *Cf.* EMISSIONS TRADING, *supra* note 7, at 74-78.

64. *See* Eheart, *supra* note 7, at 174.

65. A dispersion coefficient would be used to translate emissions from each source into their contribution to pollutant concentration at each receptor. Permits in this type of system are defined in terms of pollutant concentrations at a given receptor point. W.D. Montgomery, *Markets in Licenses and Efficient Pollution Control Programs*, 5 J. ECON THEORY 395, 416 (1972). Such a system prevents violations at any receptor point and is efficient under perfect competition for each receptor market. *Id.*

existence of multiple simultaneous markets, a polluter that affects multiple receptors must simultaneously obtain permits in the markets for each affected receptor in order to arrange a permit purchase and subsequent increase in emissions. To ensure that the air quality restraint is satisfied at every location, a large number of receptor markets is necessary, and this would significantly raise search and other transaction costs.[66] These high transaction costs, as well as the administrative complexity of the markets, would likely produce a very imperfect market with insufficient trading. Under these conditions many good trades would be bypassed and the market would be unlikely even to approach the least-cost equilibrium.[67]

Some economists have suggested the use of a pollution offsets system (POS), which would define permits in terms of emissions but restrain trading by air quality considerations at specific receptor points. Air dispersion modeling would be used to examine the effects of trades on various receptor points. This kind of system avoids the "small market" problems of a zoned market system by allowing trading between any sources in the market. However, each permit's value is linked to the effect of emissions at various receptors, and permits would be revalued after each transaction depending on the location of the source holding the permit. To accomplish this, each transaction must be analyzed by an air dispersion model. A POS program circumvents some of the problems posed by an APS, because each polluter is only concerned with those receptors whose air quality would violate the standard as a result of an increase in emissions.

While POS programs achieve an admirable level of efficiency under the conditions of perfect competition, many of their inherent characteristics act to restrain perfect competition. Pollution offset systems are very complex and require a great deal of information and administration. For example, sources would not know the trading ratio until their trades were simulated. While air dispersion modeling has been upheld by the courts as acceptable for making "yes-no" determinations in the state implementation plan[68] (SIP) approval process, it may not be accurate or reliable enough as the basis for determining trading ratios.[69] Additionally, possible ineq-

66. *See* Lefties, *supra* note 53, at 39.

67. *See id.* at 42-43.

68. Clean Air Act § 110 (a)(2), 42 U.S.C. § 7410(a)(2) (1988 & Supp. III 1991).

69. *See* Bruce M. Kramer, *Air Quality Modeling: Judicial, Legislative and Administrative Reactions*, 5 COLUM. J. ENVTL. L. 236 (1979); *see also* EMISSIONS TRADING, *supra* note 7, at 31.

uities may arise because identical sources may have widely disparate control costs solely by virtue of their locations. This could have severe repercussions on the competitiveness of output markets. Because each source may affect multiple receptors, and potential trading partners may affect some of these same receptors and some different ones, transactions between sources will cause "spillover" air quality improvements at receptors not affected by the original buyer source. This situation provides an opportunity for sources not involved in the trade to take advantage of these air quality improvements and increase their own emissions, thus acting as "free riders" on the original transaction. This problem can be largely avoided if free riders are included in the bargaining process and thus have an incentive to abate their emissions to the efficient level. Unfortunately, such a process would greatly increase the complexity and costs of the transaction.[70]

The complexity of these more structured methods of preventing sensitive zone deterioration threatens to compromise the liquidity and efficiency of the trading market. Under RECLAIM, the significance of this "hot spot" problem, if it exists at all, remains to be seen. With this in mind, it would be best for SCAQMD to keep the market as simple as possible and to monitor the flow of permits to determine if emissions appear to be accumulating disproportionately in any particular region of the District. If "hot spots" do begin to develop, SCAQMD can invoke trading restrictions as necessary. This could be done by closing off the zone of concern and banning sources in that zone from purchasing any permits from outside it, although trading among sources within that zone would still be allowed. Furthermore, SCAQMD should warn sources when emissions in a particular region approach 90% of the maximum allowable emissions in order to allow them to consummate any external trades that they may be planning.

B. *Structure of the Trading Market*

A successful market is critical to the success of RECLAIM. Without efficiency and liquidity, the projected cost savings will not be realized. Considering that cost effectiveness was the principal fuel for the development of RECLAIM, cost savings must be realized for RECLAIM to succeed. In the RECLAIM Summary Recommendations,[71] SCAQMD recognizes that the structure of the

70. *See* Albert McGartland, *A Comparison of Two Marketable Discharge Permit Systems*, 15 J. ENVTL. ECON. & MGMT. 35, 42-43 (1988).

71. RECLAIM SUMMARY RECOMMENDATIONS, *supra* note 8, at 4-11.

market[72] must evolve to suit the needs of the participants. It also recognizes the need to facilitate the development of the market so that active trading will ensue rapidly.

1. Choosing a Trading Market

The market's success rests on the tripod of efficiency, information dissemination, and liquidity.[73] Transaction costs — in terms of the time and resources involved in market access, decision making, and obtaining information — must be minimized in order for the market to efficiently allocate permits at the lowest cost. A number of mechanisms are available for information dissemination, including catalogs, bulletin boards (published or computer accessed), newsletters, and trade journals. The RECLAIM Summary Recommendations propose using a computer bulletin board system similar to that used by the NASDAQ exchange.[74] This kind of information source is most effective when tied to an organized market structure as a simple and low-cost trading system. However, questions still remain as to whether the volume of trading under RECLAIM can sustain this kind of market.[75] To a large extent, the selection of a trading mechanism will determine the volume of trading, and at the same time, the volume of trading will determine the most appropriate trading mechanism. This leaves SCAQMD in a "Catch-22" position in choosing a trading mechanism.[76]

In many ways the choice of a trading mechanism relates to the selection of a baseline allocation system. Under the kind of grandfathering that SCAQMD seems to favor, a large volume of trading will be needed in order to achieve an equilibrium distribution, and a structured market will be needed to facilitate this trading to ensure that the equilibrium is achieved.[77] Unfortunately,

72. Several scholars have addressed concern about the development of market power and its effect on an emissions trading program. EMISSIONS TRADING, *supra* note 7, at 125-48 (Chapter six deals exclusively with trading market structures and assesses concerns over market price manipulation and the strategic minimization of competition in output markets.); Walter S. Misiolek & Harold W. Elder, *Exclusionary Manipulation of Markets for Pollution Rights*, 16 J. ENVTL. ECON. & MGMT. 156 (1989) (comparing the threats of cost-minimizing manipulation and exclusionary manipulation, with a pronounced emphasis on the latter); David A. Malueg, *Emission Credit Trading and the Incentive to Promote Technological Change in Pollution Control*, 16 J. ENVTL. ECON. & MGMT. 52 (1989) (investigating the effect of non-competitive output markets on the social welfare of an emissions trading program).

73. RECLAIM SUMMARY RECOMMENDATIONS, *supra* note 8, at 4-11.

74. *Id.* at 4-15.

75. *Id.*

76. *Id.*

77. *Id.* at 4-14.

uncertainty in the initial stages of the market and the lack of a price signal may make it very difficult to promote vigorous trading.

By contrast, a transfer-neutral auction in which refunds are distributed according to the same parameters as a grandfathering baseline allocation will achieve the same final distribution of permits and financial benefits, but it will reach equilibrium much more rapidly while immediately establishing a clear price signal. Additionally, because this market will be starting from equilibrium, the required trading volume will be smaller since trading will only be needed to maintain this efficient distribution as conditions change. A transfer-neutral auction thus requires a less structured market with less direct involvement of SCAQMD. In effect, the transfer-neutral auction as a baseline allocation tool mimics the role of a call auction[78] as a trading market tool.

A large and active market would be needed to sustain a continuous exchange.[79] Yet continuous trading would be vulnerable to price swings. The RECLAIM Summary Recommendations suggest that a dealer market would be too illiquid and dealers may find it too risky to handle emissions credits.[80] Consequently, a call market appears attractive because of its increased liquidity and compatibility with a smaller number of participants.

2. Call Markets

A call market is an automated trading system "characterized by restricted hours of trading, with concentrated trades in order to achieve maximum liquidity."[81] The Wunsch Auction System,[82] promising low transaction fees and easily accessed information, is an ideal trading market for RECLAIM. It employs a call auction market linked to a computer system which is accessible by a personal computer modem.[83] Such a system obviates the need for brokers or dealers and further reduces transaction costs by providing easily accessible market information. Bid and sell offers can be accessed via the computer system to obtain updates on changing prices. The system accepts bid and sell offers continually but

78. *See infra* part IV.B.2.

79. SCAQMD, WORKING PAPER #4: EMISSIONS TRADING 'THE CENTERPIECE' 5-2 (Oct. 24, 1991).

80. *See generally* RECLAIM SUMMARY RECOMMENDATIONS, *supra* note 8, at G-4.

81. *Id.* at G-3.

82. The Wunsch Auction System will be renamed the Arizona Stock Exchange. *Id.* at G-4.

83. *Id.*

matches them only twice a day.[84] By matching bids twice a day, the system avoids price swings while evading the time delay problem of a typical auction system.[85] Bankers' Trust serves as a clearinghouse, matching trading offers and keeping cash reserves in accounts for the participants.[86] Once a trade is made, the clearinghouse transfers the securities from the buyer's account to the seller's account, thus providing a rapid and liquid transfer system.[87]

This market combines a high level of efficiency, liquidity, and information dissemination with enough structure to escape trading compliance problems. The Wunsch Auction System facilitates flexibility in price negotiation when unmatched trades occur by contacting the buyer and the seller and attempting to negotiate a settlement. As a result, the Wunsch Auction System combines many of the benefits of the types of markets discussed previously[88] while minimizing their drawbacks. Furthermore, such a system would require relatively little SCAQMD involvement and would be appropriate for relatively small markets such as RECLAIM.

3. Permit Leasing

Whatever market approach SCAQMD decides to use, the role of permit leasing will likely be critical to the success of RECLAIM. Because the early stages of RECLAIM will undoubtedly be characterized by significant uncertainty, firms are likely to play the market very conservatively. Speculation about the future status of the market and the price of permits, as well as uncertainty on the part of individual participants about their future production and equipment needs, will likely result in reduced trading and market efficiency. Permit leasing allows sources that are uncertain about their future needs to lease permits that they are not using in the short run but which they are reluctant to sell outright. Similarly, sources planning to install control equipment or make process changes could ensure their continued compliance during the transition period by leasing permits. The relatively short duration of a leasing agreement allows both the lessor and the lessee to act within a more concrete time frame and improves flexibility with respect to sources' transitional needs. Furthermore, permit leasing helps sources to

84. *Id.*
85. *Id.*
86. *Id.* at G-4, G-5.
87. *Id.*
88. *See supra* part III.C.1-3.

"get their feet wet" in the market without necessarily having to make long-range decisions in an atmosphere of uncertainty.

The RECLAIM Summary Recommendations and Working Paper #4 do not address the issue of permit leasing; however, the RECLAIM program should explicitly include an option to lease permits. Passive permission to lease permits is not sufficient, because if the transaction costs are too great, leasing will be discouraged. RECLAIM should actively facilitate permit leasing by creating standard procedures that will make it a quick and easy process.

To the greatest extent possible, SCAQMD should standardize, facilitate, and encourage permit leasing. RECLAIM can facilitate leasing by providing information on leasing "bid" and "ask" conditions along with normal trading information. The Wunsch Auction System's computer network could include this information, but the parties would have to negotiate leasing arrangements individually. In effect, the leasing market could be a direct-search market acting as a corollary to the main permit market. SCAQMD should define negotiation procedures and restrictions and use standard forms to finalize leasing agreements. Additionally, it should monitor leasing arrangements along with permit transactions, taking them into account when considering "sensitive zone" accumulations and employment impacts.

C. *Potential for Market Manipulation*

The acquisition of market power by one source or a group of sources within RECLAIM would threaten the cost savings of the tradeable permit system. If a firm with potential market power does not receive a number of permits equal to the number that it would hold in equilibrium, then the cost of abatement will be greater than the least-cost solution.[89] The extent to which the allocation deviates from equilibrium will be directly related to the extent to which abatement costs deviate from the cost-minimizing solution.[90] Factors determining the extent of market power include the level of allowable emissions and the shape of the marginal abatement curves for the market power source and for all other sources.[91] When these other sources receive permit allocations below their level of uncontrolled emissions, then the relationship between the market

89. Hahn, *supra* note 38, at 756-57.
90. *See id.*
91. *Id.* at 759.

power source's permit holdings and their initial allocation is not unique. As a result, the market power firm can exploit the other sources' inelastic demand curves.[92]

Because a source's baseline allocation determines its potential for market manipulation, an incentive-compatible auction, and to a lesser extent a transfer-neutral auction, are preferable to grandfathering. They are much more likely to equate a market power source's baseline allocation with its equilibrium allocation. When the firms submit their permit request schedules, SCAQMD would have full knowledge of demand functions and could use this information in a transfer-neutral auction to ensure that the refund procedure does not allow the potential market power sources to manipulate the market.

Under any allocation system, it appears likely that a large number of permits will become concentrated in the hands of a few large emitters. However, it should also be noted that possession of a large number of permits does not necessarily mean that a source can influence the outcome in the permit market. If a source that holds a large number of permits has a higher value or need for those permits than do other sources in the market, then the source cannot exert market power. Only when a source receives a substantial excess of permits above what it needs can it influence permit prices via market manipulation. For this reason, many economists maintain that the anti-competitive effects of a transferable discharge permit (TDP) system are not likely to be very important in general.[93] If a source does have market power, the effect on price depends on that source's excess demand for permits. The baseline allocation would result in monopsony if the potential market power source received significantly fewer permits than it needed; it would result in a monopoly if the source received many more permits than it needed.[94] If a monopoly is created, the degree to which the market power firm can raise the market price of a permit is moderated by the risk that it could force other firms to shut down operations, thus reducing demand for the permits.

Under auction allocation methods, the allocation of control responsibility is not cost-effective when a firm acts as a pricesetter.[95]

92. *Id.* at 761.

93. *See* Thomas H. Tietenberg, *Transferable Discharge Permits and the Control of Stationary Source Air Pollution: A Survey and Synthesis: Reply*, 56 LAND ECON. 391, 414 (1980).

94. *See* Hahn, *supra* note 38, at 763.

95. Tietenberg, *supra* note 93, at 414.

Nevertheless, simulations involving a very small number of sources in which the price-setting source was responsible for about half of the total emissions have shown that the rise in total control costs is negligible even though permit prices may change by twenty percent.[96] Under RECLAIM, the large number of participants and more evenly distributed emissions would make the market much less amenable to this form of manipulation.[97]

While the above-mentioned forms of market manipulation minimize costs to the market power firm, exclusionary manipulation seeks to raise costs to rivals in the same industry or to block the entry of new competitors. Under exclusionary manipulation, a firm buys more permits than it needs in order to raise competitors' costs of buying permits. This is a manipulation strategy that raises the firm's costs in the short-run because of excess buying but may significantly reduce costs in the long-run.[98]

If a grandfathering baseline allocation system allocates an excess number of permits to a price-setting source, that source would simply refuse to sell those permits, thereby enabling it to block competition. The potential for exclusionary manipulation is also partially determined by the trading mechanism involved. If each permit transaction is negotiated individually, sellers can refuse to sell permits to competitors in order to gain an advantage in the output market. An auction market in which bid and ask prices are matched automatically, without reference to the identity of the buyer or seller, would help reduce the threat of this kind of market manipulation.[99]

Exclusionary manipulation is likely to be most significant in industries which depend upon specific natural resources or which serve very local markets and in non-attainment regions where the number of available permits is low and cannot be bought from other regions. This situation is most likely to occur in a zoned market or an ambient permit system. For the most part, exclusionary manipulation does not appear to be of significant concern for RECLAIM, because most of the sources that emit enough to be included in RECLAIM do not operate in exclusively local markets.

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96. *Id.*

97. Interestingly, this kind of manipulation strategy raises the control costs and control responsibility of the price-setting firm while the price-takers receive all of the benefits. *See* EMISSIONS TRADING, *supra* note 7, at 128-30.

98. *See* Walter S. Misiolek & Harold W. Elder, *Exclusionary Manipulation of Markets for Pollution Rights*, 16 J. ENVTL. ECON. & MGMT. 156, 164 (1989).

99. *See* EMISSIONS TRADING, *supra* note 7, at 138-39.

Even if firms could monopolize permits in one region, they would not be able to prevent competitors from moving to other regions. Furthermore, exclusionary manipulation requires significant long-range planning and risk-taking. Therefore, firms are unlikely to use exclusionary manipulation in the relatively uncertain environment that RECLAIM will likely create in its early stages.

V.
A HOLISTIC PROPOSAL FOR SELECTION OF A BASELINE ALLOCATION SCHEME AND TRADING MARKET MECHANISM

To achieve air quality goals at a lower cost than under command and control approaches, RECLAIM must establish an efficient market structure. In order to achieve this goal, it is essential to select the baseline allocation mechanism and the market approach in a holistic manner. These decisions must be made together in order to allow the processes to complement one another. The existing literature on emissions trading program design analyzes these issues in isolation and under perfect market conditions while ignoring the reality that certain aspects of these programs impose considerable transaction costs and manipulation potential which will produce a very imperfect market. SCAQMD has fallen into this same trap by dividing planning responsibilities for RECLAIM among separate working groups for market structure, baseline allocation, and socio-economic impacts, among others.[100] Furthermore, the existing options for designing such a program vary with respect to liquidity, efficiency, time to reach equilibrium, equity, enforceability, degree of SCAQMD involvement, and vulnerability to manipulation.

A. *A Transfer-Neutral Baseline Allocation and Refund Scheme*

Under a transfer-neutral auction, the baseline allocation is determined through an auction mechanism in which the highest bidders receive permits according to their relative value for those permits. This produces an efficient equilibrium allocation. The redistribution process, in which the revenues generated by the auction are divided and distributed among the participating firms, addresses the equity concerns.

Each source would submit a demand schedule for permits that is essentially the reverse of its control cost curve. Each permit would then be allocated to the source that has the highest value for it. The

100. *See* RECLAIM SUMMARY RECOMMENDATIONS, *supra* note 8, at 1-2.

permit price would be determined as under a single-price auction, in which each source would receive permits at the level set by the lowest-accepted bid. For an auction involving "n" permits, the single price would be set at the level of the bid demand for the n^{th} permit. After the demand schedules are processed, the highest bidding firms would then be charged the same price for all of their permits. This market price, equalling the lowest-accepted bid, would serve as a price signal in the ensuing market.

The revenues generated by the auction would then be distributed among the firms in the market according to a formula that accounts for each firm's production efficiency and compliance history. Each firm's refund would be reduced according to the number of permits that it acquired in the auction so that firms who benefit from the auction do not receive a duplicative benefit from the refund process. This benefits smaller firms whose lack of capital makes them unable to compete effectively in the auction, while simultaneously discouraging large firms from attempting to manipulate the market. This allocation strategy is an attempt to juggle equity concerns with fairness. Sources that produced inefficiently or had a history of past noncompliance would be forced to bear a larger burden than sources that minimized their emissions and developed innovative programs such as ridesharing and recycling.

With this kind of single-price auction there may be some concern about the potential for auction or market manipulation. While this potential does exist to some extent, an effective manipulation strategy would be very difficult to develop and successfully carry out. A source that entered the auction under the assumption that all other sources will truthfully reveal their bids, would find it virtually impossible to alter the outcome of the auction in its favor. If a source overbid for permits in an attempt to hoard them and monopolize the market, it would effectively raise the market permit price while simultaneously reducing its share of the refunds, because the number of permits it purchases is deducted from the point total that determines its refund.[101] Additionally, it would be unable to sell "extra" permits at a profit, because they were originally bought at a price higher than the market price.

An alternative manipulation strategy would be to underbid for permits in an attempt to secure a larger share of the refunds. However, by underbidding, a source would lower the market permit price, which would simultaneously lower auction revenues and the

101. *See infra* pp. 323-24 describing a proposed refund system.

source's own refunds. Furthermore, the source would then be forced to buy permits from other sources at a higher price than it could have obtained them for in the auction. If that source were to enter the auction assuming that other sources would all try to overbid, it would have no incentive to do so itself, because it could then receive larger refunds and could likely purchase permits from other sources in the post-auction market for less than the auction price.

The only effective manipulation opportunity would be if all the other sources were trying to underbid and one firm were able to bid above the other sources' bids but still below the true equilibrium market price. This would enable the source to acquire very cheap permits that it could later sell at a higher price in the market. However, for this strategy to be viable, the source would need accurate information about the other sources' actions as well as a lot of luck. No firm is likely to pursue such a strategy, because it is tremendously risky and could prove disastrous. Furthermore, the actual RECLAIM market will contain many sources having a relatively even distribution of market power. As a further safeguard against market manipulation, SCAQMD could monitor the auction bids to ensure that such a strategy would not work.

The transfer-neutral auction is preferable to a grandfathering scheme in which equity is addressed through the initial distribution of permits, for three reasons. First, the transfer-neutral auction reaches a least-cost equilibrium immediately, so that cost savings are maximized from the very beginning of the program. Grandfathering relies on the assumptions of a perfect market — perfect information and no transaction costs — to reach this same equilibrium distribution. However, in the early stages of RECLAIM these conditions will be very difficult to fulfill and the program's efficiency (cost savings) will suffer each day the market is not in equilibrium. Second, because the market starts from an equilibrium position in a transfer-neutral auction system, it does not require as high a trading volume to maintain market efficiency compared with the volume of trading required under grandfathering. This reduces the burden on SCAQMD to develop a sophisticated and administratively cumbersome trading market. Third, the transfer-neutral auction gives an early price signal to the participating firms, which will also help promote market efficiency. In essence, the auction is a simulated round of trading that gives the firms some early experience with the trading market and how it works. An auction mechanism will diminish much of the initial

mystery and uncertainty of the market. For the forgoing reasons, a transfer-neutral auction would serve as a natural lead-in to the trading market and would promote a harmonious transition into RECLAIM.

A transfer-neutral auction also maximizes equity considerations. Because the auction would produce cash refunds, unlike a grandfathering system which addresses equity through permit allocations, SCAQMD would have greater flexibility in making equitable choices. Since each source values permits differently, allocating permits as an equity-promoting process is inherently inequitable. While the market mechanism attaches some standard value to the permits, the assumptions of a very liquid market must hold true for this standard value to be truly realized. As I have suggested in the preceding paragraphs, it is fairly likely that such liquidity will not be achieved in the early stages of RECLAIM.

Additionally, a transfer-neutral auction provides a large potential to integrate other considerations into the baseline allocation process. First, refunds could be distributed over time so that the redistribution process could be used as an incentive or disincentive to engage in certain business activities. The first few years of RECLAIM will be crucial to its success or failure. For this reason, sixty percent of the refunds should be released in the first year and twenty percent in each of the next two years. Extending the period of redistribution to three years will reduce the incentives for some sources to take the money and close down their businesses or move out of the air quality management district. Sources that leave the District would not receive the remainder of their refunds. After firms have been acting in the market for three years, there would be little incentive for them to leave, because they would have already invested resources in RECLAIM. However, it is important that the majority of the refunds be given in the first year so that firms have funds available to install control equipment or reformulate products. The problem of businesses leaving the District after receiving refunds could also be handled by deducting permit charges from participants' refunds, or vice versa, and by simply providing some seed money for control costs which the firm would repay at a later date. Similarly, the refund process can be designed to create disincentives to use process shutdowns (and resulting job layoffs) as a means of reducing emissions or saving money to purchase permits. The control authority could give sources that use these strategies smaller refunds. In this way, the refund process can be used to

monitor the activity of firms during the first three years of RECLAIM.

The control authority can also use the refund process as a positive incentive by giving larger refunds to sources that have or develop innovative programs such as ridesharing, recycling, or energy efficiency. Sources that currently use ozone-depleting substances instead of ROGs will eventually have to switch to ROGs, as required by Subchapter VI of the Clean Air Act of 1990. These firms argue that they should receive "credit" in their baseline allocations for their use of ozone-depleting substances, because they will have to switch to ROG-emitting replacements over the next few years. The District could appease these firms through the refund process by giving them larger refunds based on the amount of ozone-depleting substances they will have to replace. These firms would then have the cash either to invest in permits in the future or to develop new alternatives. Furthermore, these sources would still have the option of purchasing extra permits in the auction to cover future emissions. However, since sources will receive a smaller refund for each permit they buy, most will probably prefer to maximize their refunds in the short term rather than stock up on permits that they will not need for several years. Under grandfathering, giving these sources more permits from the start, when they do not yet need them, removes permits from circulation that could go to sources that need them immediately. This leads to an inefficient market, because chlorofluorocarbon (CFC) users and producers essentially will hoard permits until they are required to replace them with ROGs. This process moves the initial allocation of permits further from the equilibrium distribution and makes it more difficult to maximize market efficiency.

Under my proposal, the refund process would function on a point system in which sources are awarded points based on their current emissions, past control efforts, and other beneficial activities. Conversely, points would be deducted for negative activities. Each source's share of the refunds would be based on its pro rata share of the total points allocated. Points would be allocated according to the following criteria.

Process points. Sources would be grouped by industry and the average amount of emissions per quantity of product produced would be determined for each industry. Emissions per quantity of product produced and total emissions in the year of highest activity between 1987 and 1991 would be determined for each source. Each source's process points would be determined by the following equa-

tion: the industry average number of emissions per product produced, over the source's emissions per product produced, multiplied by total emissions. Thus, for each industry, the sources that have lower emissions levels for the amount of product produced compared with the industry average would receive more process points per unit of their emissions. This system would reward firms that have already installed best available control technology (BACT) or that have found another way to produce their products efficiently.

CFC allowance points. In the ROG market, CFC producers would receive points based on their CFC emissions, but they would not receive full value for these emissions. For example, CFC points could be awarded according to a two-for-one exchange in which CFC sources would receive one point for every two units of ozone-depleting emissions. CFC allowance points would be equivalent to units of CFC emissions divided by two.

"Small business" points. Because small businesses will have a competitive disadvantage in the auction due to economies of scale and fewer resources, they should receive extra points in compensation. This compensation could take the form of a predetermined number of points for all small businesses, or it could be determined as a factor of the number of employees or the source's output. A small business would need to be defined. The definition might be, for example, a business having fewer than forty employees.

Innovative program points. Sources with innovative programs, such as low-emissions fleet vehicles or recycling, could receive bonus points depending upon the quality and size of the program. Points would be allocated based on the number of vehicles in a low-emissions fleet vehicle program. For recycling programs, points would be awarded based on the amount of waste reduced or recycled. Other innovative programs could include the retiring of old cars and energy conservation, in which points would be awarded based on the number of cars retired and the amount of energy saved by energy-efficiency measures. Ridesharing requirements could also be converted into a point formula.

Points would be deducted based on the number of permits a firm purchases in the auction. This prevents these firms from receiving a duplicative benefit and discourages firms from trying to manipulate the market. Additionally, small firms whose lack of financial resources makes them unable to benefit from the auction itself can be compensated by the refund process. Sources that go out of business would receive no points and no refunds. Penalty point deductions

would be assessed for layoffs, partial closures, and past noncompliance according to the following schedules.

Job closure and layoff deductions. Sources that lay off workers to generate funds for control efforts, or those that eliminate a portion of their operations (thereby laying off workers) to reduce emissions would suffer point deductions depending on the extent of the layoffs.

Past noncompliance deductions. Sources with a history of noncompliance, or that are found not to be in compliance during the refund period, would have points deducted — the number depending on the level of noncompliance.

It may be desirable to restructure the point system after the first year so as to place greater emphasis on innovative programs and employment impacts in the second and third years. Since the second and third years each distribute one-third of the refunds allocated in the first year, the process points should be devalued to one-third their original value in order to place greater emphasis on employment impacts and innovative programs. Firms that develop innovative programs in later years would be credited for their actions by receiving more points and greater refunds. By holding the auctions at four- or five-year intervals, this procedure provides an almost continuous monitoring process with clear monetary rewards and penalties. By releasing the refunds over a period of a few years, SCAQMD can monitor employment impacts, withholding refunds from sources that close down partially or completely. Additionally, a positive incentive exists for sources to institute innovative programs that improve air quality because those sources will receive larger refunds.

B. *Linking the Auction Scheme to the Market Mechanism*

A transfer-neutral auction scheme, using as a trade mechanism a call auction like the Wunsch Auction System, would lead to the most efficient market system. Whereas SCAQMD has concentrated almost exclusively on grandfathering to determine baseline permit allocations, a transfer-neutral auction with refunds determined under the same formula as a grandfathering scheme would achieve the same equilibrium result — but more quickly and with less potential for manipulation. Using a point system like the one outlined in the previous section, SCAQMD could release refunds over a period of a few years and use the refund system to create positive incentives to achieve environmental, economic, and social objectives related to employment levels, ridesharing, and equity considera-

tions, among others. Additionally, a timed release of funds over a few years would mitigate the possibility that firms would take the money and leave the District. Finally, a transfer-neutral auction gives an early price signal that facilitates the transition to the ensuing permit market.

By holding transfer-neutral auctions every four or five years and defining permit lifetimes by these intervals, a simultaneous and multilateral trading forum will arise. Emission rights could be transferred for one-year periods during each four- or five-year interval, but the source that purchased a permit in an auction would retain the actual property right to the permit. At the end of the one-year period, the emission rights would return to the permit owner unless the sources agreed to renew the trade agreement. This arrangement clearly defines the property right to the permit, and the one-year trading interval makes the permit price easy to determine, because it can be directly compared to the marginal control cost for that year without having to factor in the future value of the permit. The basic permit right could not be confiscated or altered during its lifetime, but SCAQMD could decide to offer fewer permits at the next auction. Additionally, this system would facilitate entry into the market by new sources, because the auction would provide an easy opportunity to obtain permits.

Ideally, the transfer-neutral auction would be jointly administered by SCAQMD and the Wunsch Auction System. Afterwards, the market could proceed under the auspices of the Wunsch Auction System alone. The allocation auction would acclimate participants to the trading process and would provide a price signal for further trading. The transfer-neutral auction would reach equilibrium immediately, and if it is reasonably incentive-compatible, it would eliminate concerns of monopoly or monopsony arising from an inefficient allocation to potential market power firms.

The Wunsch Auction System provides a high degree of liquidity and efficiency and is also capable of administering a small market with limited trading. Trading volume would be limited, because the transfer-neutral baseline allocation immediately achieves equilibrium, unlike grandfathering. The Wunsch Auction System does not require brokers and is capable of providing sufficient information to maintain low transaction costs.

Under the system this Comment proposes, SCAQMD would have access to trading information and would monitor the geographical distribution of permits in order to prevent air quality degradation in sensitive zones. If "hot spots" did begin to appear,

SCAQMD could restrict firms in such areas from purchasing permits from other regions. Furthermore, it could monitor the market to detect the possible development of monopoly or monopsony conditions.

Finally, SCAQMD should encourage and facilitate permit leasing as a means of alleviating problems that could occur from uncertainty in the early stages of RECLAIM and during transitional periods when control equipment is being installed. SCAQMD should formalize leasing procedures and restrictions so as to reduce transaction costs with respect to leasing arrangements. The Wunsch computer database should include information about leasing options and should make it accessible to sources along with regular trading information. Active encouragement of permit leasing is critical to the efficiency of RECLAIM and must be integrated into the normal trading process.

VI.
CONCLUSION

The design of the RECLAIM market involves a wide range of decisions and criteria that SCAQMD must approach in a unified, holistic manner. If SCAQMD does not integrate these decisions, the resulting market is unlikely to function smoothly or efficiently.