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**AN ECONOMIC ANALYSIS OF TITLE IV OF THE 1990 CLEAN AIR ACT:
THE FAILURE TO CONSIDER THE LOCAL IMPACT OF
SULFUR DIOXIDE EMISSIONS**

*Philip J. Susser**

Introduction

To some commentators incentive-based regulation represents the future for all environmental regulation.¹ As traditional pollution control technology becomes more expensive, they argue, the trend will be toward programs that regulate behavior to reduce emissions.² We thus will see more taxes on gasoline, subsidies for mass transit, and incentives for recycling. Because incentive-based programs are one of the most effective ways to regulate behavior in a free society, it seems likely that if Congress wants to further reduce emission levels, it must rely increasingly on market forces to ameliorate air pollution problems.³

Not surprisingly, then, Congress' passage of a marketable rights program as part of the 1990 Clean Air Act has sparked significant academic interest.⁴ Indeed, the success of the marketable rights program may dictate the speed with which Congress enacts future incentive-based programs.⁵ Therefore, problems with the program's effectiveness in dealing with localized air pollution effects must be addressed and corrected, or at least understood, so that they can be avoided in any future programs.

This marketable rights program, known as Title IV of the Federal Clean Air Act Amendments of 1990 (Title IV), is designed to regulate sulfur dioxide emissions from utilities.⁶ By forcing polluters to buy rights to pollute on the market, Title IV forces polluters to internalize the cost of their emissions.⁷ This, in turn, decentralizes the decision-making process for optimizing pollution control by shifting it away from the government and towards the individual polluter.⁸ With this added flexibility, proponents contend, emissions can be further reduced for less money.⁹

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¹ Robert W. Hahn & Robert N. Stavins, *Incentive Based Environmental Regulation: A New Era from an Old Idea?*, 18 *ECOLOGY L.Q.* 1, 27 (1991).

² *Id.* at 32.

³ *Id.*

⁴ A search in Westlaw's JLR database of "'Clean Air Act' /3 1990 /P 'Title IV'" yielded 37 journal or law review articles.

⁵ Jeanne M. Dennis, Comment, *Smoke For Sale: Paradoxes and Problems of the Emissions Trading Program of the Clean Air Act Amendments of 1990*, 40 *UCLA L. REV.* 1101, 1142-43 (1993).

⁶ Clean Air Act Amendments of 1990, Pub. L. No. 101-549, 104 Stat. 2399 (codified at 42 U.S.C. §§ 7651-7651o (1988 & Supp. 1993)).

⁷ WORLD RESOURCES INSTITUTE, *THE 1994 INFORMATION PLEASE ENVIRONMENTAL ALMANAC* 105 (Allen Hammond ed., 1994).

⁸ SENATE COMMITTEE ON ENVIRONMENT AND PUBLIC WORKS, *CLEAN AIR ACT AMENDMENTS OF 1990*, S. REP. NO. 228, 101st Cong., 1st Sess. 261, 303 (1990), reprinted in 1990 U.S.C.A.N. 3645, 3686 [hereinafter SENATE COMM. ON ENVIRONMENT AND PUBLIC WORKS] ("[T]he reduction programs established by this title maximize the range of choices sources have for complying with their emissions limitation requirements.")

⁹ *Id.* at 3686 ("Through this flexibility, the bill minimizes costs and maximizes . . . efficiency. EPA estimates this added flexibility could reduce total costs of the program by at least 20 percent."); Bruce A. Ackerman & Richard B. Stewart, *Reforming Environmental Law*, 37 *STAN. L. REV.* 1333, 1341, 1342 (1985) ("A system of tradable rights will tend to bring about a least-cost allocation of control burdens, saving many billions of dollars annually.")

However, the effectiveness of this program hinges on whether the costs to polluters actually matches the social costs of pollution.¹⁰ Herein lies the central problem with Title IV. Title IV does not adjust for variations in the social cost of sulfur dioxide emissions, even though the damage caused by pollution varies from region to region. Specifically, certain regions are naturally more susceptible than others to sulfur-dioxide-induced acid rain.¹¹ Additionally, human factors, such as population density and a desire to maintain pristine areas, cause variations in the social costs of acid rain damage from one location to another.¹²

This paper will outline three possible modifications to Title IV which would allow actual costs of emitting sulfur dioxide to match its social costs without significantly increasing administrative, liquidity or other costs. These modifications involve the creation of a regional marketable rights program, a combined marketable rights/emission fee program, or a variable allowance value program. Each program has particular costs and benefits. For example, the regional marketable rights program does not allow for trading between regions and is more likely to have liquidity problems, whereas the combined marketable rights/emission fee program and variable allowance value program have higher information costs. Although this paper will outline the theoretical advantages and disadvantages of each of these modifications, a more detailed analysis by the United States Environmental Protection Agency (EPA) is necessary to determine which program would be best for sulfur dioxide emission.

History of Federal Environmental Regulation

An important year in the history of environmental regulation was 1970. In addition to the inauguration of Earth Day, Congress enacted the first comprehensive and effective program to control pollution.¹³ This program, appropriately entitled the Clean Air Act of 1970, addressed two objectives: (i) it authorized the EPA to directly regulate the emission levels of certain polluters and (ii) it strengthened previous legislation which required states to develop and implement plans to reduce their pollution levels.¹⁴

Pursuant to the Clean Air Act, the EPA sets maximum emission levels for a variety of pollutants, including sulfur dioxide, at all newly constructed or modified sources.¹⁵ In addition, after evaluating the effectiveness of different pollution control technologies, the EPA approved of certain techniques for meeting these standards.¹⁶ Under this system, from 1970 to 1976, the EPA required utilities to reduce their emissions by either using low-sulfur coal or installing scrubbers to clean smoke before it escaped into the atmosphere.¹⁷

However, in response to increased political pressure by high-sulfur coal producing

¹⁰ Hahn & Stavins, *supra* note 1, at 6.

¹¹ SENATE COMM. ON ENVIRONMENT AND PUBLIC WORKS, *supra* note 8, at 3653 (Figure IV-6 shows "regions of North America with low geochemical capacity for neutralizing acid deposition.").

¹² For additional discussion see *infra* text accompanying notes 77-92.

¹³ Clean Air Act Amendments of 1970, Pub. L. No. 91-604, 84 Stat. 1676 (codified as amended at 42 U.S.C. § 7411 (1988)); Hahn & Stavins, *supra* note 1, at 1 (noting that the first Earth day was in 1970).

¹⁴ 42 U.S.C. § 7411 (1988); see Dennis, *supra* note 5, at 1106, n.15.

¹⁵ 42 U.S.C. § 7411 (1988).

¹⁶ Dennis, *supra* note 5, at 1107.

¹⁷ *Id.* at 1106-07.

states, Congress passed the 1977 Amendments to the Clean Air Act. These amendments indirectly required all utilities, regardless of the type of coal that they used or how much sulfur dioxide they emitted, to install scrubbers,¹⁸ thereby eliminating the “competitive advantage” for low-sulfur coal producers.¹⁹ This inefficient sulfur dioxide control program remained in place for thirteen years, and the debate over changing it lasted nearly as long. Senator George J. Mitchell first proposed a new sulfur dioxide control program in 1981.²⁰ This program required a 10-million-ton reduction in sulfur dioxide emissions from the 1980 levels within ten years of the bill’s enactment.²¹ These reductions were to be allocated to 31 states based on an “excess emissions” formula.²² The excess emissions formula required utilities to reduce their sulfur dioxide emissions in proportion to the amount of sulfur dioxide they emitted in excess of 1.2 pounds per million British Thermal Units (BTU) of heat input.²³ This proposal placed a greater burden on states which may not have polluted very much in absolute terms but produced high emissions relative to the amount of energy produced. Like any proposal that shifts the burdens of environmental cleanup, this proposal faced strong opposition from the states who were to bear most of the costs of the new regulations.²⁴ This proposal was supplemented and then replaced by various proposals throughout the 1980s, including a 1983 national cost-sharing bill which would have taxed all non-nuclear power sources and used the funds to clean up the fifty highest-emitting power plants; a two-phase emission reduction program which would have required a two-stage reduction in the average state emissions per BTU produced; and, a 1988 compromise bill which would have required 32 specific plants to retrofit, the cost of retrofitting to be borne by a tax on all plants emitting more than 1.0 pound per million BTUs, combined with a second phase which required a reduction in each state’s average level of emissions.²⁵ The debates over these bills kept Congress occupied for nearly a decade until the legislation introduced in 1989 was ultimately enacted as the Clean Air Act Amendments of 1990.²⁶

The Mechanics of Title IV

Title IV was specifically designed to control sulfur dioxide emissions in the most efficient manner possible, by allowing the free market to determine the cheapest way to control emissions.²⁷ In order to achieve efficient reductions, Congress created a traditional marketable rights program. Specifically, it set a cap on the total sulfur dioxide emissions

¹⁸ *Id.* at 1107; SENATE COMM. ON ENVIRONMENT AND PUBLIC WORKS, *supra* note 8, at 3720.

¹⁹ HOUSE COMM. ON INTERSTATE AND FOREIGN COMMERCE, CLEAN AIR ACT AMENDMENTS OF 1972, H.R. No. 294, 95th Cong., 1st Sess. 184 (1977), *reprinted in* 1977 U.S.C.C.A.N. 1077, 1263 [hereinafter “H.R. No. 294”]; Dennis, *supra* note 5, at 1107. For a more detailed discussion of this program, see *infra* text accompanying notes 126-29.

²⁰ Richard L. Trumka, *Deferred Cost Sharing Through Title IV of the 1990 Clean Air Act Amendments*, 3 VILL. ENVTL. L.J. 247, 249 (1992) (citing S. 1706, 97th Cong., 1st Sess. (1981)).

²¹ *Id.* at 249-250.

²² *Id.* at 250.

²³ *Id.*

²⁴ The argument seemed to stem from a belief that certain states were bearing a disproportionate amount of the costs of this pollution control scheme. *Id.* at 250-251.

²⁵ *Id.* at 252-256 (citing H.R. 3400, 98th Cong., 1st Sess. (1983), and H.R. 4567, 99th Cong., 2d Sess. (1983)).

²⁶ 42 U.S.C. §§ 7651-7651o (1988 & Supp. 1993).

²⁷ See generally SENATE COMM. ON ENVIRONMENT AND PUBLIC WORKS, *supra* note 8, at 3686.

that could be discharged nationally by the utility industry, then allocated among the nation's utilities the rights or allowances to pollute.²⁸

The reductions are to be made in two phases. In the first phase, legal emissions will be reduced by three to four million tons by 1995. In the second phase, legal emissions will be capped at 8.9 million tons and remain at that level thereafter.²⁹ Phase I seeks reductions primarily from large, relatively dirty plants, whereas phase II seeks reductions from practically all existing plants.³⁰ By the year 2000, the government will no longer issue any additional allowances to new or expanded plants.³¹ Accordingly, operators of such plants must either redistribute their allowances internally by making corresponding reductions in emissions from their existing plants or by purchasing allowances on the market. This limitation is known as the Greenfield cap.³²

An exception to this deadline is provided for sources that are being rebuilt with clean coal technology. If a source is being rebuilt (meaning more than just retrofitting), the source's deadline for meeting phase II reductions will be extended until December 31, 2003.³³

For the most part, though, after the year 2000 all plants will be prohibited from emitting sulfur dioxide in excess of their allowances.³⁴ Each allowance represents a limited right to emit one ton of sulfur dioxide for one year.³⁵ The allowances can be transferred among point sources at one utility firm, stored for future emissions, leased, or sold.³⁶ Thus, in order for any utility to emit sulfur dioxide, it must use an allotted allowance or purchase one on the open market.³⁷

Moreover, to encourage an active market in the allowances, the administrator of the EPA "should not restrict unduly the ownership of allowances."³⁸ To this end, "the administrator [of the EPA] must recognize the need for a wide variety of commercial arrangements such as leases, sales agreements, and exchanges for emissions and for electric power or capacity [and] the administrator must also be cognizant that an option-in-futures market is likely to develop around this new commodity."³⁹ By allowing for such a wide variety of transactions, Congress intended to create an active and robust market for the allowances and thereby avoid any liquidity problems.⁴⁰

²⁸ 42 U.S.C. § 7651b(a) (1988 & Supp. 1992); 42 U.S.C. § 7651b(e) (1988 & Supp. 1993).

²⁹ Henry A. Waxman, *An Overview of the Clean Air Act Amendments of 1990*, 21 ENVTL. L. 1721, 1792-1793 (1991); see also 42 U.S.C. § 7651b (1988 & Supp. 1993).

³⁰ *Id.*; see also 42 U.S.C. § 7651d (1988 & Supp. 1993).

³¹ 42 U.S.C. § 7651b(e) (1988 & Supp. 1993).

³² Waxman, *supra* note 29, at 1793.

³³ 42 U.S.C. § 7651h (1988 & Supp. 1993).

³⁴ 42 U.S.C. § 7651b(e) (1988 & Supp. 1993).

³⁵ 42 U.S.C. § 7651a(3) (1988 & Supp. 1993).

³⁶ 42 U.S.C. § 7651b(b) (1988 & Supp. 1993).

³⁷ 42 U.S.C. § 7651b(e) (1988 & Supp. 1993).

³⁸ SENATE COMM. ON ENVIRONMENT AND PUBLIC WORKS, *supra* note 8, at 3703 ("In fact, ownership of allowances by brokers, investors, or other market makers will maintain fluidity in the allowance market, link ultimate utility buyers with original sellers and facilitate rational price-finding."). *Id.*

³⁹ Margaret Kriz, *Emission Control*, NATIONAL JOURNAL, July 3, 1993, at 1699 (futures contracts will allow utilities to protect themselves from fluctuations in the price of sulfur dioxide allowances).

⁴⁰ For a more detailed discussion, see *infra* text accompanying notes 152 & 153.

Advantages of Title IV and Marketable Rights Programs

The advantages of a marketable allowance program for sulfur dioxide emissions are numerous. The most common rationale for marketable rights programs is that the programs are cost efficient; that is, they are the least costly method for reducing emissions.⁴¹ Indeed, in enacting Title IV, Congress explicitly relied on this rationale in justifying the marketable rights program to the public.⁴² But cost efficiency is only one of many reasons for supporting such a program. Marketable rights programs are more politically palatable because they compensate the polluters for cleaning up.⁴³ Second, they are easier to set. Finally, they allocate costs efficiently, spur research and development, and automatically adjust to population and economic growth.⁴⁴

Title IV, like all marketable rights programs, uses economic incentives to reduce pollution in the least costly manner.⁴⁵ In short, the program allows "cheap-to-control" polluters the right to sell excess allowances to "expensive-to-control" polluters, thereby reducing the total cost of controlling pollution. More specifically, since each polluter can buy or sell any excess rights, the opportunity cost for polluting or for controlling pollution is the price of an allowance to pollute. Thus, in evaluating whether to invest in new technology to reduce pollution, a polluter will balance the cost of polluting (i.e., buying that allowance) against the cost of investing in the new technology (i.e., retrofitting or rebuilding a plant).

Since both existing and new polluters are faced with the same opportunity costs of pollution, they both will pollute up to the point where the cost of controlling an additional unit of pollution (i.e., marginal pollution control costs) equals the price of an allowance to pollute.⁴⁶ When both firms' marginal pollution control costs are the same, neither firm will be able to profit from reducing its emissions and selling the right to those emissions to another firm. Thus, when no firm can make any profits from trading rights in the market, the aggregate cost of pollution control will be minimized. This is true, regardless of whether that control comes from retrofitting old plants or building new plants.⁴⁷

However, since bureaucrats and politicians can in theory make all the same decisions as owners and managers, Title IV and all marketable rights programs will save money only if managers and owners are better than politicians and bureaucrats at making decisions about how best to use scarce resources at their plants. Such an assumption appears to be reasonable.⁴⁸ Because the owners and managers have more knowledge of their own plants

⁴¹ Hahn & Stavins, *supra* note 1, at 10.

⁴² SENATE COMM. ON ENVIRONMENT AND PUBLIC WORKS, *supra* note 8, at 3686.

⁴³ Hahn & Stavins, *supra* note 1, at 8 ("Charges have not been widely adopted in this country in part, probably, because industry has sound economic reasons to resist the implicit transfer of wealth involved in most effluent fee approaches.").

⁴⁴ See *infra* text accompanying notes 46-89 for additional discussion of each of these features of Title IV.

⁴⁵ SENATE COMM. ON ENVIRONMENT AND PUBLIC WORKS, *supra* note 8, at 3686.

⁴⁶ Ackerman & Stewart, *supra* note 9, at 1342, n.20.

⁴⁷ This analysis explains why when marginal pollution control costs are equal, aggregate pollution control costs will be minimized. Thus, a goal for an effective pollution control program will be to equalize marginal pollution control costs. *Id.* n.19.

⁴⁸ Owners and manager may not be superior decision-makers in all cases, but for the purposes of this article I will assume that this is in fact true. This assumption is a much debated topic. For further discussion of this issue in the context of risk management, see Peter Huber, *Safety and the Second Best: The Hazards of Public Risk Management in the Courts*, 85 COLUM. L. REV. 277 (1985); but cf., Clayton P. Gillette & James E. Krier, *Risk, Courts, and Agencies*, 138 U. PA. L. REV. 1027 (1990).

and of how best to reduce pollution there, they are better able to decide whether to reduce pollution by choosing technology A over technology B or by purchasing an allowance.⁴⁹ In addition, owners and managers have an inherent advantage in making decisions because they are more willing to take calculated risks to develop and exploit new pollution control technology.

Bureaucrats are often overly risk-averse. They display this characteristic for two reasons.⁵⁰ First, they must ordinarily be even-handed in their requirements to lower pollution. Thus, if they require one plant to install a technology, they must require all similarly situated plants to install that technology. This perspective imposes higher error costs upon each decision to install a technology, because if that technology were costly and ineffective, the entire industry would suffer. Conversely, if an owner or manager made that same decision, only that plant would suffer. Thus, by shifting the decision-making to owners and managers, a more flexible system which would allow more experimentation would be created. Second, although both private and public managers are subject to agency costs, which often makes them overly risk averse, the spectrum of costs and benefits faced by public managers makes them particularly risk-averse and therefore bad decision makers. Agency costs occur whenever a manager or bureaucrat is representing someone else, so that not all costs and benefits of their decisions are internalized. These agency costs are blamed for making managers overly risk-averse, because managers do not reap all the gains of an accurate decision.⁵¹ This is particularly true in the case of bureaucrats, because the "upside" of their compensation is severely restricted for political reasons, particularly when contrasted with the significantly larger salaries of top managers in the private sector.⁵² Thus, the benefits side of the compensation spectrum for private managers will more closely match the benefits of an accurate decision than will the spectrum of benefits realized by government employees. Substantially wrong decisions by both public and private managers, on the other hand, are ordinarily penalized in the same way: the manager is fired.

Although the visibility of an error affects the amount of scrutiny both public and private managers receive from those who suffer its costs, the structure of government employment and politics seems to make public managers particularly susceptible to penalties for very visible errors (especially in relation to the likelihood of being penalized for an error of equal magnitude which is not very visible). The imbalance between the costs of highly visible and less visible errors makes many managers, but particularly government managers, risk-averse. Because of both the magnitude and the visibility of large errors, bureaucrats are generally penalized severely for large errors (even if they were reasonable, calculated risks), but not at all for small, practically invisible errors (slightly inefficient

⁴⁹ Ackerman & Stewart, *supra* note 9, at 1343.

⁵⁰ In fact, private managers are ordinarily better decision makers for many reasons. For example, bureaucrats are more likely to be captured by special interests, and therefore make the wrong decisions. For a more detailed discussion of this issue, see Gillette & Krier, *supra* note 48.

⁵¹ See generally Michael C. Jensen & William H. Meckling, *Theory of the Firm: Managerial Behavior, Agency Costs and Ownership Structured*, 3 JOURNAL OF FINANCIAL ECONOMICS 305 (1976).

⁵² Even the President of the United States has a salary of only \$200,000 per year. Linda K. Harris, *Kid's Talk*, PHILADELPHIA INQUIRER, February 21, 1993, at L5.

decisions). As a result, these public managers have little incentive to take risks with potentially severe losses even if those risks are on balance reasonable.

Bureaucrats are disproportionately penalized for large errors because the media will focus on agencies when they make such errors; however, if it is merely inefficiency, it will not garner headlines. This is true even if the aggregate cost of chronic or systemic inefficiency exceeds the cost of that one big blunder. On the other hand, private managers are more consistently under scrutiny – whether they are disciplined by the stock market, corporate raiders, or their boards of directors. Moreover, because many of these overseers are professionals, they are less likely to be swayed by the visibility of an error.

In any case, such cost efficiency – whether achieved by private or by public managers – also will lead to an efficient level of research and development (R&D). Polluters will have an incentive to develop new technology to control pollution in order to reduce their demand for emission rights. Since they can sell any excess pollution rights, their incentive to create new technology to reduce pollution by one unit will equal the price of a right. Thus, a rational polluter will invest in R&D to the extent that the expected cost of R&D for a one-ton reduction in emissions equals the price of one allowance. If this were not the case and the expected cost of R&D to reduce emissions by one ton were less than the price of an allowance, then a polluter would be better off investing in more R&D and in fewer allowances.⁵³ This result occurs because the cost to the polluter of reducing pollution through R&D is less than buying an allowance. In terms of economics, total costs will be minimized when the marginal cost of R&D per ton of emissions reductions equals the price of an allowance. When this formula is expanded to take into account existing pollution reduction technology, total costs will be minimized when the marginal cost of control and the marginal cost of R&D are each equal to the price of an allowance.

Efficiency improvements and cost savings alone did not lead Congress to pass Title IV.⁵⁴ Indeed, many commentators would argue that the primary reason Title IV was enacted is not that it is efficient, but that it compensates existing polluters for controlling pollution.⁵⁵ After the allowances are allocated, they will constitute a right to a resource – that is, the right to emit sulfur dioxide into the air.⁵⁶ Such a resource can be quite valuable. Indeed, initial prices for sulfur dioxide emissions allowances were \$250-400 each, and, as of 31 March 1993, prices ranged from \$122 to \$450 a ton.⁵⁷ By giving existing polluters these rights for free, the marketable rights program compensates them for their acceptance of and support of the new program.

⁵³ This works in reverse as well. If the expected cost of R&D to reduce one more ton of emissions were more than the price of an allowance, then a polluter would be better off buying another allowance and investing in less R&D.

⁵⁴ The main purpose of this bill was to reduce the amount of sulfure dioxide & oxides of nitrogen being emitted into the air in order to reduce acid rain damage to both humans and the environment, without imposing severe costs on the industry. SENATE COMM. ON ENVIRONMENT AND PUBLIC WORKS, *supra* note 8, at 3685, 3700.

⁵⁵ SENATE COMM. ON ENVIRONMENT AND PUBLIC WORKS, *supra* note 8, at 3707 (“The value of those allowances will be determined in large part by the cost of reducing or avoiding the emissions against which they are applied. . . . Allowances are intended to function like a currency that is sufficiently valuable to stimulate efforts to acquire it through innovative and aggressive efforts to reduce emissions more than required.”). See also Ackerman & Stewart, *supra* note 9, at 1342, n.20.

⁵⁶ 42 U.S.C. § 7651a(3) (1988 & Supp. 1993).

⁵⁷ Kriz, *supra* note 39, at 1699. Emilia Askari and Hiawatha Bray, *To Improve Air Rights to Pollute is Auctioned Cleaner Companies Can Profit by Selling Emissions Allowances*, DETROIT FREE PRESS, March 31, 1993, at 4A.

Moreover, once these rights have been allocated, the industry is more likely to favor monitoring programs to "ensure that cheating by others does not depreciate the value of the permit holders' investment."⁵⁸ Rather than seeing the government as an obstacle to growth, the polluters may see it as a referee maintaining a level playing field.⁵⁹

Similarly, existing polluters will resist any attempts to increase the number of outstanding rights in order to prevent diluting the equity in their rights.⁶⁰ In this way, the program is less likely to be abused by special interests gaining exemptions. Although Title IV's initial allocations contain numerous exemptions from the standard allocation system, even those are limited by the absolute limit of 8.9 million tons of emission per year.⁶¹ Moreover, the true effectiveness of the program in fighting special interests will be in preventing new rights from being allocated, rather than in the initial system of allocating the rights.

Moreover, Title IV, in contrast to the pre-Title IV command and control system, allocates costs efficiently. In the pre-Title IV system, firms paid only for the cost of pollution control technology and not for the cost of the pollution they emitted. Since these pollution costs were not borne by the producers, they were not passed along to consumers. Thus, the ultimate price of energy to consumers did not reflect the cost of pollution to the environment. This mismatch between the price of energy and the social costs of pollution created two significant inefficiencies in the market for energy. First, the failure to include the cost of pollution in the cost of energy production amounted to a subsidy for energy consumption. As a result, all other factors being equal, the nation over-consumed energy.

By internalizing the cost of pollution as well as that of pollution control technology, Title IV and other marketable rights programs solve this first problem. In the Title IV system, pollution costs will be represented in the cost of pollution allowances.⁶² Thus, since the cost of polluting will now include the cost of these allowances, the actual costs of pollution will equal the social costs of pollution.⁶³ Ultimately, when social costs equal social benefits, the new program will be allocatively efficient.⁶⁴

Second, the pre-Title IV system distorted the market so that consumers over-consumed energy from expensive-to-control polluters and under-consumed energy from cheap-to-control polluters. In the pre-Title IV system, the cost to consumers reflected only the cost of pollution control technology and not the cost of the amount of pollution discharged. Since pollution costs were not included in the polluters' costs, some expensive-to-control polluters may have had lower total pollution related costs⁶⁵ than some cheap-to-control

⁵⁸ Ackerman & Stewart, *supra* note 9, at 1346.

⁵⁹ *Id.* at 1345-46.

⁶⁰ J.H. DALES, POLLUTION, PROPERTY AND PRICES 93-97 (1968).

⁶¹ More than forty different allocation formulas exist. Waxman, *supra* note 29, at 1793-1795.

⁶² The legislative history shows that one of Congress's purposes in enacting Title IV was to "reduce the emissions of acid rain precursors by reducing the amounts of electric energy . . . needed for a given task." SENATE COMM. ON ENVIRONMENT AND PUBLIC WORKS, *supra* note 8, at 3722.

⁶³ This assumes that the number of allowances sets a price that accurately estimates the social costs of pollution. Although this assumption may be incorrect, any pollution control program requires a measurement of the social cost of pollution and will therefore be subject to the same error.

⁶⁴ This assumes that the price people are willing to pay for energy is equal to the social benefits of pollution. Without any market distortions, such as monopolistic behavior by OPEC, this assumption should be true.

⁶⁵ Pollution related costs equal pollution costs and pollution control costs.

polluters. Because of their lower pollution related costs these expensive-to-control polluters could under-price some cheap-to-control polluters. Ultimately, this market distortion led to over-consumption of energy produced by expensive-to-control polluters. Clearly, since we want to favor energy production by cheap-to-control polluters, this system was inefficient. As we analyze modifications of the marketable rights programs *supra*, this type of inefficiency will be referred to as allocative inefficiency.

Last, Title IV will automatically adjust to population and economic growth.⁶⁶ This is not an inherent advantage of a marketable rights program, but rather a political benefit of the program. Both alternative programs, command and control or emission fees, must be adjusted regularly for population and economic growth. Specifically, as the economy and population grow, the demand for the product produced by polluters will ordinarily expand. This increased demand will lead to more plants, which, even if the polluters control at the same rate as the existing plants, will increase the total amount of pollution emitted.⁶⁷ Moreover, even if the aggregate amount of pollution remained the same, the social costs of pollution would increase because the number of people affected by each ton of pollution emitted would increase.⁶⁸ Thus, the demand for clean air and the demand to pollute would grow over time. Command and control and emission fee programs adjust for only one aspect of this growth, the increased demand for products produced by polluters.⁶⁹ To do so, Congress or an administrative agency would need ultimately to increase either the fees or the command and control requirements to reflect the increased demand for clean air. This adjustment can be costly in terms of calculation and error costs.⁷⁰

On the other hand, Title IV will in a rough way automatically adjust for these factors with the use of the greenfield cap.⁷¹ The greenfield cap sets an absolute limit on the amount of pollution that can be emitted from the public utility industry.⁷² By fixing the supply of pollution allowances in this way, the increased demand for energy will only be reflected in an increased price of an allowance.⁷³ Then, as each utility adjusts to maintain cost efficiency, the increased price of an allowance will spur increased pollution control and increased spending on R&D.⁷⁴ In this way, Title IV, like all marketable rights programs, adjusts to population and economic growth.⁷⁵

⁶⁶ Ackerman & Stewart, *supra* note 9, at 1349.

⁶⁷ See generally P.R. Ehrlich & J.P. Holdren, *Review of Commoner, The Closing Circle*, 14 ENV'T 24, 26, 38 (1972).

⁶⁸ *Id.*

⁶⁹ COUNCIL ON L. RELATED STUD., ENVTL. LAW INST., EFFLUENT CHARGES ON AIR AND WATER POLLUTION 36-38 (1973) (emission fees must be adjusted for population and economic growth, while permits do not); Ackerman & Stewart, *supra* note 9, at 1349 (discussing why under a BAT approach, i.e., a form of command and control, regulators must "consistently undertake new difficult, and unpopular initiatives to impose ever more stringent . . . controls on existing sources").

⁷⁰ This is particularly so because of the institutional bias (both access and process bias) favoring large, concentrated special interests. See generally Gillette & Krier, *supra* note 48.

⁷¹ Waxman, *supra* note 29, at 1793. This adjustment may not be precise, but it is more likely to be accurate than if there were no adjustment. Although population and economic growth are likely to increase both the social costs and social benefits of pollution, they may not increase at the same rate. To the extent they do not increase at the same rate, the marketable rights program will need to be adjusted.

⁷² Title IV explicitly requires all new or expanded sources to purchase allowances in the market. 42 U.S.C. § 7651b(e) (1988 & Supp. 1993).

⁷³ Ackerman & Stewart, *supra* note 9, at 1349.

⁷⁴ SENATE COMM. ON ENVIRONMENT AND PUBLIC WORKS, *supra* note 8, at 3686.

⁷⁵ COUNCIL ON L. RELATED STUD., *supra* note 69, at 36-38.

Moreover, the concerns that monitoring costs will increase dramatically with a marketable rights program are unwarranted.⁷⁶ With the development of a system for continuously monitoring emission levels, the costs of monitoring a marketable rights program will not be much greater than a command and control program and probably no less than an emission fee program. Since command and control programs already require regular monitoring to ensure that companies not only have pollution control technology, but are also regularly using that technology, the only significant additional expense may be creating a registry for all pollution rights. Such costs are unlikely to outweigh the foregoing benefits of Title IV.⁷⁷

The Local Impact Problem

Title IV and traditional marketable rights programs are not necessarily effective when the location of the polluter is significant.⁷⁸ The acid rain problem, which Title IV attempts to solve, is a perfect example of such a situation. Acid rain's impact varies from state to state and from region to region.⁷⁹ Research indicates that acid rain adversely affects human health by aggravating respiratory problems and contaminating the food we eat and the water we drink.⁸⁰ In addition, acid rain damages forests, lakes, and soil, killing many of the life forms that rely on them.⁸¹ Certain regions, including 26 states in the Eastern United States and 11 states in the Western United States, are particularly susceptible to acid-rain-induced damage.⁸² According to the National Wildlife Federation, a region's potential for such damage is "dependent on a combination of the acidity of the precipitation falling on the area and the ability of its water, soil, and rocks to neutralize increases in acidity."⁸³ Thus, it is clear that the impact of acid rain is not uniformly mixed throughout the nation.⁸⁴ Varying state impacts, as will be discussed in more detail *infra*, underline the need for a more fine-tuned pollution control program.

However, fine-tuning a pollution control program requires additional information. In an ideal world, policy makers would know which sources of sulfur dioxide emissions (i.e., point sources) caused which damage. Unfortunately, we do not live in such an ideal world.⁸⁵ Nevertheless, studies suggest that even if damage to specific areas cannot be attributed to specific polluters of emissions, "strong regional relationships" exist "between SO₂ emissions and acid depositions."⁸⁶ For example, sulfur dioxide emissions in the Midwest are thought to cause the acid rain in the Northeast.⁸⁷ These concentrated regional effects or

⁷⁶ *Id.*; Note, *Acid Rain, Emissions Trading and the Clean Air Act of 1989*, 15 COLUM. J. ENVTL. L. 329, 346, 355 (1990).

⁷⁷ James Krier, Lecture at the University of Michigan Law School (Fall 1993) [hereinafter "Krier Lecture"].

⁷⁸ Waxman, *supra* note 29, at 1752-1753, 1794-1796; *see also* Ackerman & Stewart, *supra* note 9, at 1350-1351.

⁷⁹ SENATE COMM. ON ENVIRONMENT AND PUBLIC WORKS, *supra* note 8, at 3653; NAT'L WILDLIFE FED'N, ACID RAIN: ITS STATE BY STATE IMPACTS at iii (April 1984).

⁸⁰ 42 U.S.C. § 7651(a) (1988 & Supp. 1993); SENATE COMM. ON ENVIRONMENT AND PUBLIC WORKS, *supra* note 8, at 3685; NAT'L WILDLIFE FED'N, *supra* note 78, at iv.

⁸¹ 42 U.S.C. § 7651(a) (1988 & Supp. 1993); SENATE COMM. ON ENVIRONMENT AND PUBLIC WORKS, *supra* note 8, at 3685.

⁸² NAT'L WILDLIFE FED'N, *supra* note 79, at i.c.

⁸³ *Id.*

⁸⁴ SENATE COMM. ON ENVIRONMENT AND PUBLIC WORKS, *supra* note 8, at 3653.

⁸⁵ JURGEN SCHMANDT ET AL., ACID RAIN AND FRIENDLY NEIGHBORS: THE POLICY DISPUTE BETWEEN CANADA AND THE UNITED STATES, 63 (1988).

⁸⁶ *Id.*

⁸⁷ SENATE COMM. ON ENVIRONMENT AND PUBLIC WORKS, *supra* note 8, at 3699; *see also* Kriz, *supra* note 39, at 1700.

costs of sulfur dioxide emissions cannot be solved by a uniform marketable rights program such as Title IV.⁸⁸

In addition to varying susceptibility to acid rain damage, many other non-scientific factors suggest that the regional social costs of pollution should be accounted for in the price of an allowance. For example, varying pollution levels in different regions allow consumers of air to choose the amount of pollution they wish to consume as part of their choice of where to live. To many, this sounds silly. People don't choose where to live based on air quality.

However, people do choose where to live based, at least in part, on the level of pollution in an area, and will therefore benefit from the opportunity to choose a particularly clean place to live.⁸⁹ Although air pollution may not necessarily be the primary factor most people consider in choosing where to live, it is a factor. For the elderly or the asthmatic, it may even be a primary factor, since the health effects can be more severe. This may explain the popularity in retirement communities forming in relatively clean areas such as Arizona and New Mexico and the most recent exodus from Los Angeles.⁹⁰ Thus, with non-uniform standards, people can choose the degree of healthy air they prefer.

Moreover, many, including Congress, would argue that controlling pollution in pristine areas such as the Grand Canyon or Yellowstone National Park is more valuable than controlling pollution in other areas. Congress made this objective clear when it set two different pollution standards for pristine areas and non-pristine, unpopulated areas in the Prevention of Significant Deterioration Program. Congress' concern about pollution in pristine areas reaching the level of pollution in the most polluted areas of the country reflects a more general desire of the American public for variable levels of pollution.

In addition to differing health choices and pristine areas, the social costs of pollution are affected by population density.⁹¹ If pollution has the same effect upon all those exposed to it, then, with all other factors being equal, an increase in the number of people exposed to pollution increases the social costs of that pollution. Thus, if a pollutant has a local impact, it may be preferable to locate it in an unpopulated rural area.⁹² This point is clearly not just theoretical, as it is the very reason that we regulate local pollution such as nuclear waste disposal. We would not allow a nuclear waste disposal site in the middle of Manhattan, downtown Chicago, or virtually any other city. In addition to concerns for

⁸⁸ Waxman, *supra* note 29, at 1752-1753; *see also* Ackerman & Stewart, *supra* note 9, at 1351.

⁸⁹ James E. Krier, *The Irrational National Air Quality Standards: Macro- and Micro-Mistakes* 22 UCLA L. REV. 323 (1974) (discussing how people opt against "better health, because they consider that the resulting benefits are not worth the costs of attaining them").

⁹⁰ Although California's recession and earthquakes are factors, poor air quality gives Los Angelenos one more reason to move.

⁹¹ WORLD RESOURCES INSTITUTE, *supra* note 7, at 302.

⁹² Although free trade in pollution will increase total utility, unwanted distributional effects may still occur. In this case, one might argue the reverse, that pollution should be located near those who benefit from its emissions, which may mean polluting more in urban areas than in rural areas. This author does not wish to make any conclusions as to the best place for pollution, as he believes that to be a question for Congress. This paper merely sets out a program which would allow Congress to adjust the impact of pollution to avoid what it believes are unfair distributions. *See infra* text accompanying notes 127-39; Krier, *supra* note 89; Hahn & Stavins, *supra* note 1, at 3 (1992); and *see* Richard J. Lazarus, *Pursuing "Environmental Justice": The Distributional Effects of Environmental Protection*, 87 NW. U. L. REV. 787 (1993), for a discussion of environmental equity issues.

health and aesthetics, regional variations in population density suggest that we should have different pollution standards for different regions of the country.⁹³

Title IV's failure to deal with the localized effects of acid rain is a failure inherent in any traditional marketable rights program.⁹⁴ Since Title IV does not adjust the price of an allowance to differing regional costs of pollution, its social costs are higher than those of a program that varies the price of polluting according to the regional social costs of polluting. For example, if the social cost of polluting is \$800 per ton in the Midwest and \$400 a ton in the Northeast (since much of the impact of sulfur in the Northeast lands in the Atlantic Ocean), then a program setting a uniform price of a right to pollute at \$600 will lead to a net social loss of \$400 if each region emits one ton. Two hundred dollars of social damage will be caused by over-polluting in the Midwest and two hundred dollars in social damage will be caused by under-polluting in the Northeast.⁹⁵

In some cases, the benefit of fine-tuning a marketable rights program may be outweighed by the cost of calculating how different pollution levels should be set.⁹⁶ However, this is unlikely to be the case with regard to sulfur dioxide emissions. Although it may not be scientifically or economically possible to adjust Title IV to evaluate the damage caused by each individual source, it is possible to limit the amount of pollution from certain regions when those regions cause a disproportionate amount of acid rain damage.⁹⁷ Moreover, even if the adjustments are not completely accurate, it is clear that at least a small adjustment will improve the current program. The last section of this paper, will discuss three representative methods for adjusting Title IV for these local impacts.

Title IV attempts to deal with the "local impact" problem through the continuing effectiveness of all other provisions of the Clean Air Act.⁹⁸ In particular, this means that any source must meet the ambient air quality standards of the state in which the source is located. Under the Clean Air Act of 1970, each state is required to create and administer pollution control programs (a.k.a. "state implementation plans" or "SIPs") to meet certain ambient air quality standards.⁹⁹ Thus, any polluter who satisfies the requirements of Title IV by owning the requisite quantity of allowances must also meet all state environmental laws, including the SIPs. Since SIPs are designed to reduce pollution in each of the state's air sheds to the air quality standards set by Congress, they will, to the extent they are followed, prevent excess pollution in any particular area. As a result, polluters will move to areas where the SIP limits have not been met, which, in turn, will tend to spread sulfur

⁹³ These reasons for variations in the pollution standards are not necessarily exhaustive. Rather they are only representative of the factors that should be taken into account when evaluating how to price a right to pollute in different regions.

⁹⁴ On the other hand, if the pollutant is uniformly mixed, the benefits of pollution control will not vary from region to region and thus can be ignored. A uniformly mixed pollutant is a pollutant with no local impact -- only a global or national impact. CFCs are a common example of a uniformly mixed pollutant. In these cases, a traditional marketable rights program will not address this problem, because what matters is not the location of the polluter but only the aggregate amount of pollution emitted.

⁹⁵ Admittedly, Title IV is an improvement over the pre-1990 Clean Air Act because it does adjust for variations in pollution control costs among regions.

⁹⁶ THOMAS TIETENBERG, EMISSIONS TRADING: AN EXERCISE IN REFORMING POLLUTION POLICY 64 (1985).

⁹⁷ SCHMANDT ET AL., *supra* note 85, at 63.

⁹⁸ 42 U.S.C. § 7651b(f) (1988 & Supp. 1993); SENATE COMM. ON ENVIRONMENT AND PUBLIC WORKS, *supra* note 8, at 3697; Waxman, *supra* note 29, at 1796.

⁹⁹ TIETENBERG, *supra* note 96, at 3.

dioxide emissions throughout the country. Ultimately, spreading the pollution in this manner is likely to disperse the harmful effects of pollution more evenly throughout the country, thereby reducing the likelihood of a “local impact” problem.

In addition, these SIPs are supplemented by two interconnected federal programs – new source performance standards (NSPS) and non-attainment (NA) programs – which also tend to disperse polluters and therefore spread pollution more evenly throughout the U.S.¹⁰⁰ Under these programs, any new or modified source must meet strict technology or performance standards. The degree of control required under these programs corresponds to the ambient air quality standards currently existing in each region. For the NSPS and NA programs, the worse that the air quality standards are, the greater the level of control required. Thus, by requiring tougher standards in areas with poor air quality, Congress has further encouraged the dispersal of all new pollution and thereby further reduced the likelihood of a “local impact” problem.¹⁰¹

However, these programs have at least one significant drawback which will be prevented by a modification of Title IV. Since the programs limit the amount of pollution permitted within a region according to the level of air quality (i.e., pollution damage) in that region, the programs may under-control or over-control pollution in each of the regions. This is because the polluters in each region may not be responsible for all the air pollution in their region. Indeed, in the case of sulfur dioxide, a substantial portion of the pollution damage in each state appears to be caused by out-of-state sources.¹⁰² Thus, if one made the standards strict in a state with poor air quality, local pollution would be over-controlled (because it is not the primary source of the pollution problem) while distant sources, the actual cause of the local air quality problem, would be under-controlled. Thus, because these SIP, NSPS, and NA standards base a region’s level of pollution control only upon the level of pollution in that region, they often over-control or under-control pollution and are therefore inefficient.¹⁰³

Potential Solutions to the “Local Impact” Problem

To solve this “local impact” and inefficiency problem with Title IV requires an evaluation of other pollution control programs. One might argue that this program supports a return to command and control programs. Command and control programs, as the name suggests, ordinarily involve one of two policy mechanisms for reducing pollution: uni-

¹⁰⁰ Modified sources under this program include only those modified sources which increase their level of emissions. *Id.* at 5.

¹⁰¹ *Id.* at 74.

¹⁰² In a study of 19 states in the North Atlantic, Appalachian, North Central, and South/Southeast regions, the potential percentage of sulfur dioxide originating from out-of-state sources was over 44% in every state. The following list describes the precise estimates. *State Potential Percentage of Sulfur Dioxide Originating From Out-of-State Sources*: Maryland 77, New Jersey 86, New York 86, Pennsylvania 77, Rhode Island 65, Kentucky 77, Tennessee 87, West Virginia 77, Michigan 44, Minnesota 70-80, Wisconsin 44, Georgia 44, Louisiana 85, Mississippi 44, North Carolina 87, South Carolina 87, Texas 85, Virginia 77. NAT’L WILDLIFE FED’N, *supra* note 79, at 135.

¹⁰³ Similarly, these programs do not adjust for varying susceptibility to air pollution. All are set by reference to the air quality within their regions or states rather than to the damage their pollution causes. See *supra* text accompanying notes 97-102 for a more in-depth discussion of this issue. In addition, to the extent the air quality standards vary between regions they also may be inefficient, because they do not allow for pareto superior trades between regions or states. The advantages of pareto superior trades between regions is discussed in more detail *infra* text accompanying note 142.

form technology-based standards and performance standards.¹⁰⁴ For example, under the first program, utilities may be required to install scrubbers to limit sulfur emissions while, under the second program, a utility may be required to reduce emissions to a pre-set level. Although these programs, in theory, have the potential to be as effective as or more effective than market-based programs, they are in practice often less effective.¹⁰⁵ Because they do not allow managers and owners of firms to choose the most efficient way to reduce pollution, they often reduce pollution at relatively higher costs than market-based programs.¹⁰⁶ Moreover, because such programs entail many small decisions regarding acceptable levels of pollution to be made by government rather than one large decision such as the greenfield cap in Title IV, they are more likely to be captured by special-interest groups.

Indeed, experience with pre-Title IV command and control programs for sulfur dioxide demonstrates the political problems which often occur in command and control programs. The 1970 Clean Air Act required that all coal power plants either use low-sulfur coal or install scrubbers, in an effort to reduce the nation's aggregate level of sulfur dioxide emissions.¹⁰⁷ This naturally led some power plants to switch to low-sulfur coal in order to avoid the cost of installing scrubbers.¹⁰⁸ However, this shift had a disproportionate impact upon the various regions. The Western United States, where low-sulfur coal is abundant, profited, while the Eastern United States suffered when demand for its high-sulfur coal dried up. Although this process was relatively efficient from a national viewpoint, Congress, to appease the special interests of eastern coal mining regions, amended the Clean Air Act in 1977 to require all power plants to install scrubbers, regardless of the type of coal they used.¹⁰⁹ For power plants using low-sulfur coal, this requirement was very onerous, particularly in relation to the limited reductions in emissions effected by the scrubbers.¹¹⁰

Moreover, many other benefits of marketable rights programs would be lost by a return to a command and control system. Such benefits include allocative efficiency, because only the cost of pollution control, and not the social cost of polluting, would be reflected in the price of energy.¹¹¹

Emission Fees

An alternative proposal would be an emission fee program similar to the Moss Proposal raised in 1971 by the Council of Law Related Studies.¹¹² Emission fee programs, if

¹⁰⁴ Hahn & Stavins, *supra* note 1, at 3.

¹⁰⁵ This can be said for command economies as opposed to market-based economies.

¹⁰⁶ Hahn & Stavins, *supra* note 1, at 3-6. For a more detailed discussion of the advantage of private decision making, see *supra* text accompanying notes 50 & 51.

¹⁰⁷ See Dennis, *supra* note 5, at 1107.

¹⁰⁸ *Id.*

¹⁰⁹ SENATE COMM. ON ENVIRONMENT AND PUBLIC WORKS, *supra* note 8, at 3720; see Dennis, *supra* note 5, at 1107.

¹¹⁰ Dennis, *supra* note 5, at 107-109.

¹¹¹ For further definition of allocative efficiency, see *supra* text accompanying notes 60-61. See also Robert Crandall, *The Political Economy of Clean Air: Practical Constraints on White House Review*, in ENVIRONMENTAL POLICY UNDER REAGAN'S EXECUTIVE ORDER 205 (V. Smith ed. 1984) (discussing how the current NSPS program is allocatively inefficient to the extent that it favors pollution by existing sources over that by new sources).

¹¹² COUNCIL ON L. RELATED STUD., *supra* note 69, at 36-38.

the fee is accurately set, have nearly all the benefits of a marketable rights program. They are cost-efficient and allocatively efficient, and they encourage R&D.¹¹³ However, fees can be particularly hard to set accurately.¹¹⁴ In marketable rights programs, such as Title IV, the aggregate level of emissions is set by Congress and is fixed, while the price of a right to pollute fluctuates.¹¹⁵ However, in emission fee programs, Congress sets the price for polluting, and the quantity polluted is a function of that price.

Not surprisingly, then, if Congress wants to set air quality standards, marketable rights programs are cheaper to establish than emission fee programs. Under each system, Congress must extrapolate, from the ambient air quality standards, how much pollution could be emitted without violating those standards. However, emission fees would also require the additional inference of how much of a fee would cause only that quantity of pollution to be emitted. This additional level of inference would require information about “how firms will respond to a given level of taxation” (i.e., the marginal costs of controlling pollution), because one would need to estimate how much pollution would be reduced by each incremental dollar of fee.¹¹⁶ Thus, by avoiding this additional level of inference, marketable rights programs are more effective than emission fee programs in reaching particular air quality goals.

However, situations may arise in which it is more costly to set air quality standards than to set emission fees directly. In those cases, establishing an emission fee program may be more cost-effective than a marketable rights program. In order to make such a determination about a particular pollutant, Congress must weigh at least two factors: (i) the error costs of miscalculating the pollutant’s abatement costs, and (ii) the error costs of miscalculating the pollutant’s harm to society.¹¹⁷

Specifically, if the abatement costs of the pollutant rise gradually, while the pollutant’s harm increases suddenly and dramatically at a particular threshold level of pollution, then a marketable rights program would be preferable.¹¹⁸ In this case, an error in setting the air quality to be achieved (and therefore the quantity of pollutant to be emitted) can be significantly more costly than an error in setting the abatement costs (i.e., price of polluting) to polluters. Thus, in such a situation, the social benefits of reducing the error in air quality outweigh the social costs of increasing the error in abatement costs. Ultimately, since a marketable rights program “assure[s] that a pre-determined level of pollution abatement will be achieved,” it will reduce the expected error in air quality and therefore reduce the total social costs of abatement error and air quality error.¹¹⁹

On the other hand, if the pollutant’s harm increases gradually, while the abatement costs rise suddenly and dramatically at a particular threshold level of pollution control,

¹¹³ Hahn & Stavins, *supra* note 1, at 7.

¹¹⁴ *Id.* at 8.

¹¹⁵ *Id.*

¹¹⁶ Hahn & Stavins, *supra* note 1, at 8.

¹¹⁷ Richard A. Westin, *Understanding Environmental Taxes*, 46 TAX LAW 327, 336, 340 (1993).

¹¹⁸ *Id.* at 340 (“For example, assume a particular level of smokestack pollution from a group of power generating stations is known to cause a dramatic increase in human morbidity. Assume also that eliminating pollution depends on improving scrubbers, and that prices of scrubbers rise steadily with their efficacy. Here one would prefer to use marketable rights, because the risks of being wrong are big and the extra costs of abatement are small.”)

¹¹⁹ *Id.* This, however, assumes that there is just as much chance of making a calculation error in setting air quality and an emission fee.

then an emission fee would be preferable.¹²⁰ In this case, an error in setting the cost of control (i.e., price of polluting) would be significantly more costly than an error in setting the quantity of pollutant emitted; therefore, an emission fee program, which fixes the price for polluting, would be preferable.¹²¹

In the end, the decision whether to use an emission fee or a marketable rights program will depend on where Congress chooses to place the risk of error. If it wishes to place the risk of error upon polluters, it will use the marketable rights program, because both the quantity of pollutant emitted and, to a large extent, the level of air quality would be fixed. Conversely, if it determines to place the risk of error on the general population (i.e., the consumers of clean air), it will use an emission fee program, because the price for polluting would be fixed, while the quantity polluted and the resulting air quality would fluctuate.¹²² An underlying assumption of this article, however, is that these information costs (as determined by analyzing the risks of harm and abatement costs from sulfur dioxide emissions) with respect to sulfur dioxide favor a marketable rights program. This assumption seems reasonable, because Congress has already passed Title IV, a marketable rights program, to deal with it.¹²³

Moreover, strategic behavior by firms limits Congress' ability to gradually adjust a fee or the quantity of rights to an efficient level. That is, if a firm realizes that Congress will reduce a fee or increase the quantity of rights if it stifles production, the firm will slow production in order to bluff Congress into lowering the fee or increasing the number of rights.¹²⁴

Other weaknesses in emission fee programs include their failure to automatically adjust to economic and population growth and their disproportionate impact on polluters.¹²⁵ Since emission fee programs do not compensate polluters for the new fees, they would indirectly transfer a substantial amount of wealth from the private sector to the government. Such redistributions are highly unpopular and make substantial emission fee programs difficult to enact.¹²⁶

In fact, many commentators would argue that it is the foregoing weaknesses with command and control and emission fee programs which led to the adoption of a marketable rights program. Thus, to solve the problem with Title IV, it may be better to adjust or supplement the present system rather than to start anew. The following section will identify three representative proposals for solving the problems with Title IV: regional marketable rights programs, marketable rights program supplemented by emission fees, and a program that allows different amounts of pollution in different regions for the same right.

¹²⁰ *Id.* This can occur if the threat exists that many firms will go out of business with too high an emission fee.

¹²¹ *Id.*

¹²² Indeed, much of the industries' resistance to tradable permits stems from this increased uncertainty. TIETENBERG, *supra* note 96, at 11.

¹²³ This assumption is supported by the argument that calculation costs for an emission fee system are higher. Many would argue that establishing an emission fee program requires more absolute information about the effects of the program, because it requires an estimate of marginal costs of control rather than just an estimate of aggregate social costs and benefits of a pollution control program. Krier Lecture, *supra* note 77.

¹²⁴ Westin, *supra* note 117, at 334. Firms have engaged in such strategic behavior since the federal government entered into environmental protection. This is particularly true in the face of uncertainty.

¹²⁵ See *supra* text accompanying notes 88-95.

¹²⁶ See *supra* text accompanying notes 65-74.

Regional Marketable Rights Programs

Regional marketable rights programs or “zonal permit systems” are ordinarily the simplest and easiest programs to administer, but in some cases that simplicity limits their flexibility and efficiency.¹²⁷ In this program, the nation would be divided into a specific number of zones, with each zone having a separate emissions limit and permit system. Under such a program, permits would not be transferable between regions, but would be exchangeable on a one-for-one basis within a region. By limiting trades in this way, this system would take location into account and thereby more stringently limit emissions in regions where pollution has a greater impact. Moreover, within each region, total costs would be minimized, as each utility would fix its marginal costs of pollution control to the price of a right in that region. Since concerns about concentrations of sulfur dioxide emissions relate to the amount of emissions from regions rather than more local areas, a system such as this, which controls the amount of pollution emitted from each region, would be particularly effective in preventing “hot spots” (i.e., substantial and disproportionate local impacts from pollution).

On the other hand, a regional marketable rights program can be inefficient because it does not create incentives for firms to make all pareto superior trades, especially trades between regions. For example, imagine a situation in the Northeast, where (i) the marginal cost of control is \$500, (ii) the price of an allowance is \$500, and (iii) the social cost of pollution is \$550. Under a regional marketable rights program, this situation could represent a state of equilibrium, because, for a firm in the Northeast, the cost of one more unit of control equals the firm’s opportunity cost or cost of buying one more allowance. However, the nation as a whole would be better off if the firm could sell that unit for up to \$550, because the social cost of polluting (\$550) exceeds the cost of control for that unit (\$500).

Next, imagine a situation in the Midwest, where (i) the cost of control is \$650, (ii) the price of an allowance is \$650, and (iii) the social cost of pollution is \$600. Under a regional marketable rights program, this situation would also represent a state of equilibrium, because, for a firm in the Midwest, the cost of one more unit of control (\$650) equals the firm’s opportunity cost or cost of buying one more allowance (\$650). However, the nation as a whole would be better off if the firm could buy another right for less than \$650, because the social cost of polluting (\$600) is less than the cost of control for that unit (\$650).

If these firms could trade, so that the Northeastern firm receives between \$500 and \$550 for a right to pollute and the Midwestern firm pays between \$600 and \$650 for that right, all parties would be better off. Indeed, this even allows the government or another intermediary between \$100 and \$200 for profit. However, a regional marketable rights program treats these markets as distinct and does not allow trades between them. Thus, such a trade would not be made and the potential added value would be lost.

Admittedly, under a regional marketable rights program, Congress could solve this problem by readjusting the allowances in each region. In this case, reducing the number of allowances in the Northeast and increasing the number in the Midwest would be the equivalent of the two parties engaging in a pareto superior transaction. However, such fine-

¹²⁷ TIETENBERG, *supra* note 96, at 74-75.

tuning by the government can be expensive, because of high calculation and error costs.¹²⁸ Indeed, it is just this type of governmental intervention that a marketable rights program attempts to avoid.¹²⁹ In contrast, firms in both a marketable rights program with emission fees and a variable allowance value program have incentives that will encourage them to automatically make these pareto superior trades.

Liquidity constraints are another potential problem with reducing a nationwide marketable rights program to its regional components.¹³⁰ Liquidity problems can arise because of the reduction in the size of the market for rights, which, in turn, would reduce the number of potential buyers and sellers. Liquidity constraints can lead to inefficiencies in many ways.

Reduced liquidity can encourage monopolists and monopsonists, who would manipulate the price of a right for their own gain, even if doing so reduces the efficiency of the system.¹³¹ For example, a monopolistic supplier of rights might hold onto an excessive supply of rights in order to artificially raise the price of rights. If the increase in the price of rights exceeds the supplier's cost of holding the excess rights (which is likely to entail under-controlling pollution) the supplier would profit. More importantly, however, under such a situation the price of a right would be higher than if the supplier did not manipulate the market. An artificially high price would lead both consumers and non-consumers of rights, who look to the market price to plan their firm's pollution control strategy, to over-control to the extent that the artificially high price exceeds the non-monopoly equilibrium price.

Even without conscious monopolies and monopsonies, reduced liquidity increases risk. With fewer buyers and sellers, fewer decisions are made about the value of an allowance; therefore, the chance that allowances will be priced inaccurately is greater.¹³² In addition, higher margins arise between offers to buy and offers to sell, and thus increase the cost of investing. This occurs because a buyer of an allowance will automatically lose the spread between the offers immediately after purchasing the right. Moreover, in extreme cases, margins may be so high that some firms may not be able to buy or sell freely rights. To avoid such a situation, firms will try not to depend on the market. In such a situation firms are likely to over invest in control technology because, to the extent a firm can control their own pollution, they will be able to avoid relying on the market and thus reduce the firm's risk.¹³³

Indeed, Title IV deals explicitly with liquidity concerns. First and most obviously, it does not divide the nation into different trading regions and therefore can take advantage

¹²⁸ This is especially true when strategic behavior by the firms is taken into account.

¹²⁹ SENATE COMM. ON ENVIRONMENT AND PUBLIC WORKS, *supra* note 8, at 3686 (discussing, as benefit of Title IV's flexibility, that it shifts pollution-control decisions to the individual polluter).

¹³⁰ Note, *supra* note 76, at 329; Kriz, *supra* note 39, at 1700.

¹³¹ Ackerman & Stewart, *supra* note 9, at 1351; SENATE COMM. ON ENVIRONMENT AND PUBLIC WORKS, *supra* note 8, at 3702 (Congress expects the market for allowances under Title IV to be "structurally competitive, because the ownership of allowances will not be concentrated.").

¹³² TIETENBERG, *supra* note 96, at 62 (speculating that, "...in markets with few participants, prices may be more uncertain...").

¹³³ See Dennis, *supra* note 5, at 1136.

of the large national utilities' market for rights to emit sulfur dioxide.¹³⁴ Second, in order to maintain an active market for buying and selling rights and to prevent "hoarding," Title IV authorizes the EPA to withhold 2.8% of the allowances that would otherwise be allocated.¹³⁵ In part by using these allowances, the EPA is given the power to "make a market" in allowances, and thereby maintain a reasonable degree of price stability and liquidity for potential buyers and sellers.

Further, Title IV's legislative history illustrates that Congress intended to create a fairly free market for allowances to spur the trading of allowances. They intended to allow for "a wide variety of commercial arrangements such as . . . leases, sales agreements[,] and exchanges between emissions and electric power or capacity" and even an options-in-futures market.¹³⁶ Such arrangements reduce the risk of owning allowances both by creating more buyers to sell to and by shifting the risk to traders (i.e., professional speculators).¹³⁷ Lowering the risk of holding allowances in this and other ways is probably the best way to spur trading and create an active market. Moreover, to facilitate both a primary and secondary market in these allowances, the Chicago Board of Trade created a private trading market in 1991, and more recently, it began offering sulfur dioxide futures contracts.¹³⁸

Besides liquidity and loss of pareto superior trade concerns, regional marketable rights programs have advantages and disadvantages similar to those of a nationwide program. They are cost-efficient and allocatively efficient, encourage R&D, adjust to economic and population growth (to the extent it is balanced among the regions),¹³⁹ and compensate utilities for accepting the new regulations. However, liquidity and loss of pareto superior trade concerns suggest either that a combined marketable rights/emission fees program or a variable allowance value program would be more efficient.

Combined Marketable Rights/Emission Fee Program

Supplementing Title IV or a similar marketable rights program with emission fees would allow the Government to take advantage of the benefits of a marketable rights program, while maintaining flexibility to deal with the local effects of pollution. Such a system would consist of a traditional marketable rights program, where Congress would set an absolute limit on the amount of pollutant, or as in this case sulfur dioxide, that may be emitted. As with Title IV, these allowances to pollute would be freely tradable, bankable, and exchangeable. However, this system would diverge from Title IV in that it

¹³⁴ SENATE COMM. ON ENVIRONMENT AND PUBLIC WORKS, *supra* note 8, at 3702 ("All indications are that the market for allowances will be economically competitive and highly robust."). Although initial trading is admittedly slow, many commentators expect trading to increase as 1995 and the phase I reductions are mandated. Kriz, *supra* note 39, at 1700; Peter Passell, *A New Commodity to be Traded: Government Permit for Pollution*, N.Y. TIMES, July 17, 1991, at A1.

¹³⁵ Waxman, *supra* note 29, at 1796, n.355; Trumka, *supra* note 20, at 264-265.

¹³⁶ SENATE COMM. ON ENVIRONMENT AND PUBLIC WORKS, *supra* note 8, at 3703; Kriz, *supra* note 39, at 1699.

¹³⁷ Kriz, *supra* note 39, at 1699 (projecting that futures contracts will allow utilities to protect themselves from fluctuations in the price of sulfur dioxide allowances). SENATE COMM. ON ENVIRONMENT AND PUBLIC WORKS, *supra* note 8, at 3703 ("The Administrator should not restrict unduly the ownership of allowances. In fact, ownership of allowances by brokers, investors, or other market makers will maintain fluidity in the allowance market, link ultimate utility buyers with original sellers and facilitate rational price-finding.").

¹³⁸ Passell, *supra* note 134, at A1; Kriz, *supra* note 39, at 1699.

¹³⁹ For more detailed discussion, see *supra* text accompanying notes 48-87.

would apply fees to discourage pollution in some areas, and as a corollary encourage it in other areas.

Specifically, the fees would incrementally raise the cost of polluting in regions where the social cost of polluting is high. For example, when the social cost of polluting is \$550 in the Northeast and \$650 in the Midwest, this program would set the number of rights so that the price of a right would equal \$550, and then set a fee in the Midwest equal to an additional \$100. In such a system the marginal cost of polluting would be \$550 in the Northeast and \$650 in the Midwest. Thus, in both the Northeast and the Midwest total social costs of pollution would be minimized as the marginal cost of polluting would be equal to the marginal social cost of polluting and the marginal cost of pollution control.¹⁴⁰ Moreover, setting the marginal cost of polluting equal to the marginal cost of pollution control would create cost and allocative efficiency and encourage an efficient level of R&D.¹⁴¹

However, as with most environmental control programs, a combined marketable rights/emission fee system has disadvantages. First, it has all the weaknesses of an emission fee system, albeit to a lesser degree.¹⁴² It does not automatically compensate the firms in regions facing the fee for accepting the new program. Thus, as in an emission-fee-only system, this system will face more political hurdles. On the other hand, those firms will be compensated for the marketable rights portion of the program. In addition, Congress can reapportion much of the tax burdens to all firms in the industry by allocating more rights to firms in high-tax regions. In fact, such imbalance may help to increase trading and create an active market in the allowances, as firms in the high-tax region, with excess rights, sell to firms in the low-tax regions.

In general, the information costs under such a system are ordinarily higher than under a traditional marketable rights program, but substantially lower than under an emission-fee-only system.¹⁴³ Setting up a fee-based system would require an estimate of the difference among the regions in the social costs of pollution and the incremental marginal control costs of firms,¹⁴⁴ while setting up a regional marketable rights program requires only an estimate of the social costs of pollution in each individual region.

A combined marketable rights/emission fee program would have lower information costs than an emission-fee-only system, because it requires an estimate of only the incremental marginal control costs, rather than of the industry's entire marginal control costs. Estimating only the incremental marginal costs of control is not likely to entail lower

¹⁴⁰ If the marginal cost of polluting were greater than the marginal social cost of polluting, society would benefit from an increase in pollution, because the resources being spent on pollution control could produce more of benefit to society in another area of the economy. On the other hand, if the marginal cost of polluting were less than the marginal social cost of polluting, society would benefit from a decrease in pollution, because the cost of preventing one more unit of pollution is less than the damage to society caused by that unit of pollution. Thus, total social costs from pollution are minimized when the marginal cost of polluting equals the marginal social cost of pollution.

¹⁴¹ For a more detailed discussion of why setting marginal costs of control equal to marginal cost of pollution results in cost and allocative efficiency and encourages R&D, see *supra* text accompanying notes 48-87.

¹⁴² For a more detailed discussion of these weaknesses, see *supra* text accompanying notes 128-38.

¹⁴³ This is based on the assumption, with respect to sulfur dioxide, that information costs are lower in a marketable rights program. See *supra* text accompanying notes 128-38.

¹⁴⁴ Information about incremental marginal control costs is necessary to estimate how much of a fee will shift enough pollution to balance the marginal cost of polluting in each region with the marginal social cost of polluting. For a more detailed discussion, see *supra* text accompanying notes 128-38.

calculation costs, but is likely to have lower *error costs* than an estimate of the industry's entire marginal costs of control. As discussed in more detail below, error costs are likely to fall because of a decline in the risk of substantial over-control or under-control of pollution. Thus, since total information costs ordinarily equal the sum of calculation and error costs, a reduction in the error costs of control is likely to result in a decline in total information costs.¹⁴⁵

This decline in the risk of substantial over-control or under-control can best be seen by varying the Northeast - Midwest hypothetical discussed above. With an elasticity of "1," in an entirely fee-based system, a 10% error in setting a fee would result in an error of \$60 per ton; that is, 10% of the average fee per ton, which is \$600. However, in a combined program, the same 10% error in setting the fee would amount to only a \$10 error; that is, 10% of the difference in social costs between the regions, which is \$100. Therefore, under a combined system, the cost of making the same 10% error would be substantially lower than it would be in an entirely fee-based system.¹⁴⁶ In this case, the additional information costs equal \$50.¹⁴⁷

On the other hand, estimating a fee is ordinarily more costly than estimating the quantity of rights in a marketable rights program.¹⁴⁸ This is because fees require information about marginal costs of control, while marketable rights programs do not.¹⁴⁹ In order to estimate the quantity of pollution that will be controlled under an emission fee program, one must know how firms will react to a new fee, i.e., whether they will go out of business, develop new technology, or install scrubbers. Since predicting each firm's reactions to different cost structures is very difficult, it can be extremely hard to accurately estimate the marginal costs of control for an industry. Thus, marketable rights programs have a big informational advantage over emission fee programs. Under marketable rights programs, one need not infer from the price of a fee the quantity of pollutant that will be emitted; one merely looks at how much is being polluted now and decide how much to cut.

Moreover, the fee in a combined program may be easier to set than in a emission-fee-only system for another reason. Polluters in a combined system are less likely to resort to strategic behavior in fighting the fees.¹⁵⁰ Since the fee in a combined program is lower, the benefits of fighting it are less. Not that polluters would not resist the fee, but such resistance would be less than it would be in an entirely fee-based system.

¹⁴⁵ Total information costs are minimized when the marginal calculation costs equal marginal error costs.

¹⁴⁶ More broadly, assuming an elasticity of "1," a 10% error in setting a fee in an entirely fee-based system would result in a 10% error in the amount of pollution discharged throughout the nation. However, a 10% error in setting the fee in a combined program would result in less than a 10% error in the amount of pollution discharged throughout the nation. To be specific, it would only result in 10% of the portion of pollution control caused by the fee. Because this portion of pollution control would be less than 100% of all pollution control under a combined system, the error under such a system would necessarily be less than the 10% of an emission-fee-only system.

¹⁴⁷ Admittedly, elasticity may not be "1," because the likelihood of making an error as a percentage of the fee may be greater for the incremental marginal control costs. This is so because the administrator of the program is most likely to make mistakes closest to the margin. Nevertheless, because the information required by the combined system is by definition less, the error costs will likely also be less. Moreover, under the combined program, if the administrator makes the same calculation error in each region, the errors will, to some extent, offset one another.

¹⁴⁸ For a more detailed discussion of why information costs are generally higher in fee systems than they are in market rights systems (particularly with regard to SO₂ emissions), see *supra* text accompanying notes 136-38.

¹⁴⁹ Westin, *supra* note 117, at 337.

¹⁵⁰ For a more detailed discussion, see *supra* text accompanying note 131.

Another concern which is associated with fee systems relates to the wealth redistribution from the producers to the government. However, to the degree the fee is smaller than in an emission-fee-only system, the redistribution will be less. Nevertheless, this may present a political problem in getting the legislation passed, because polluters will not be fully compensated for their endorsement of the program. Furthermore, polluters in the regions where a fee is imposed will argue that they are being disproportionately burdened by the fee. However, this second problem can be easily solved by compensating those polluters by giving them a preference in the initial allocation of pollution rights.¹⁵¹ In theory, this could spread the burdens of the fee across the entire industry.¹⁵²

Similarly, certain regions might argue that they would be paying a disproportionate share of annual taxes to the federal government in the form of fees. However, this concern can also be easily addressed. Any surplus can be redistributed back to the region from which it came in the form of grants. Thus, individuals will still have an appropriate incentive to reduce energy consumption, but will not necessarily suffer an additional financial penalty for living in the region. Individuals will suffer a penalty only to the extent that their energy use is reduced less than that of other people within their region.

In addition, one might argue that the individual regions should evaluate the social costs of pollution, and then choose to supplement the marketable rights program with an emission fee. However, economics and past experience shows that this is unlikely to be done, at least to the efficient level of fee. Until the original Clean Air Act of 1970, most pollution control efforts were left to the states, but they failed to implement sufficient programs. Indeed, the states' failure to act led the federal government to pass the Clean Air Act of 1970.

Furthermore, sulfur dioxide pollution has many externalities which discourage states from setting a high enough (or sometimes any) fee. Specifically, a study of nineteen states in five different regions of the continental United States revealed that up to 44% of sulfur dioxide emissions in each state (and significantly more in some cases) originated from out-of-state sources.¹⁵³ Thus, if each State acted solely in its own interests, the level of national pollution control would be substantially less than the optimum.

Thus, in order to determine whether to favor a combined program over a regional marketable rights program, the EPA or Congress must balance the additional information and administrative costs of a combined system against the liquidity costs and trade distortions of a regional marketable rights program.

Variable Allowance Value Program

However, a variable allowance value program may solve some of the problems of both the combined system and the regional marketable rights program. A variable allowance value program would entail a nationwide marketable rights program similar to Title IV, except that the value of a right would vary between regions. The value would be propor-

¹⁵¹ SENATE COMM. ON ENVIRONMENT AND PUBLIC WORKS, *supra* note 8, at 3707. Indeed, Congress may have had such redistributions in mind when it stated that "[t]he value of those allowances will be determined in large part by the cost of reducing or avoiding the emissions against which they are applied."

¹⁵² For a more detailed discussion in the context of a regional marketable rights program, see *supra* text accompanying notes 61-66.

¹⁵³ See *supra* note 101 and accompanying text.

tional to the social costs of polluting in that area. If the social costs of pollution are relatively high in a region, then the value of an allowance (in terms of amount of emissions permitted) would be relatively low.

Using the Northeast - Midwest hypothetical discussed earlier, the following example should illustrate both how this program would work and how it would encourage pareto superior trades.¹⁵⁴ In the Northeast, the control cost of pollution is \$500, the price of an allowance is \$500, and the social cost of pollution is \$550, while, in the Midwest, the control cost of pollution is \$650, the price of an allowance is \$650, and the social cost of pollution is \$600. The coordinator might set the value of one allowance equal to the right to emit 1.0909 (i.e., 60/55) tons of sulfur dioxide in the Northeast and one (55/55) ton of sulfur dioxide in the Midwest. Then, as in all free markets, firms would trade until their total costs were minimized; thus, in this case, they would trade until the marginal costs of polluting 1.0909 tons (60/55 tons) in the Northeast equaled the marginal cost of polluting 1 ton in the Midwest.¹⁵⁵ This would result in the socially optimum level of pollution, because the social cost of polluting in the Midwest exceeds the social costs of polluting in the Northeast by 9.09% and the ultimate cost of a right would equal \$600 in the Midwest and \$550 in the Northeast. By fixing the social costs of pollution to the actual costs of pollution, this system is allocatively efficient and cost-efficient and spurs R&D.¹⁵⁶

Moreover, this system would allow for pareto superior trades between regions and is just as liquid as any marketable rights program.¹⁵⁷ Unlike the regional marketable rights system, this program does not obstruct or deter any trades. The program would encompass the same market as an ordinary program, and trades could be made freely within that market. In this regard, this program would act, like Title IV, as an ordinary marketable rights program.

A principal benefit of this program over a combined emission fee/marketable rights program is that it need not entail any redistribution of wealth from polluters to the government. In fact, any unfairness created by the lower value of allowances in certain regions can be fully compensated for by adjusting the initial allowances to reflect these differences in value. In this way, a variable allowance value program is more politically palatable than a combined system.

In addition, this system would not require adjustment for population or economic growth so long as that growth was proportionate among regions. In contrast, under an emission fee or combined program, the fee portion of the program will require periodic adjustment for economic and population growth even if such growth were the same in all regions because the value of the fee portion would no longer match the higher demands for polluting caused by growth.¹⁵⁸ On the other hand, if growth between regions were dispro-

¹⁵⁴ For a more detailed discussion of why information costs are higher in fee systems than in marketable rights programs, see *supra* text accompanying notes 136-38. For a discussion of the benefits of making pareto superior trades, see *supra* text accompanying notes 140-44.

¹⁵⁵ In the preceding hypothetical, the firms will be in equilibrium when the price of the right is equal to \$650.

¹⁵⁶ For a more detailed discussion of why setting firms' actual pollution costs at a level equal to the social costs of their pollution promotes cost-efficiency, allocative efficiency, and R&D, see *supra* text accompanying notes 48-87.

¹⁵⁷ For a more detailed discussion of the benefits of liquidity, see *supra* text accompanying notes 141-53.

¹⁵⁸ For a more detailed discussion of the effects of growth on emission fee programs, see *supra* text accompanying notes 89-95.

portionate or the relative costs of pollution between regions were to change for some other reason, then it would not matter which system was used, as all three representative systems would require adjustment.

On the other hand, a variable allowance value program would require the same marginal cost information required by the combined marketable rights/emission fee program. In both the variable allowance value program and the combined fee and right program, Congress sets the national limit for pollution, by the number of rights issued, and merely uses the fee or variation in allowance value to redirect pollution into less socially costly areas. To this end, in order to set the allowance values or fees in each of these programs, the coordinator must know the marginal cost of controlling pollution and the relative social costs of pollution in each area. Otherwise, the coordinator cannot predict how the pollution will be distributed or where it will be deposited for each set of allowance values. In other words, in setting allowance values, the coordinator must know what impact any change in value may have on the actual amount emitted in each region.

Summary of Three Representative Programs

Each of the three foregoing modifications to Title IV - a regional marketable rights program, a combined marketable rights/emission fee program, and a variable allowance value program - attempts to set the marginal costs of controlling pollution equal to the marginal social costs of polluting. Thus, each is cost-efficient and allocatively efficient and encourages an optimum level of R&D. However, each program has certain advantages and disadvantages which makes it more suitable for particular pollution problems.

In short, the regional marketable rights program ordinarily requires lower information costs to initiate than other programs, because it does not require any information about the marginal cost of polluting in the different regions. However, it is inefficient to the extent that it does not allow pareto superior trades and reduces the liquidity in the allowance market.

The combined marketable rights/emission fee program is superior to the regional marketable rights program to the extent that it allows for pareto superior trades and does not reduce the market for allowances. However, it is inferior to the extent that it requires information about the marginal cost of controlling pollution, does not adjust to economic and population growth, and shifts wealth away from polluters to the government.

Last, a variable allowance program is similar to a combined marketable rights/emission fee program in that it allows pareto superior trades, does not reduce the market for allowances, and requires information about the industry's marginal cost of control. However, it need not be adjusted for economic and population growth as would a combined program, because it automatically adjusts for growth that is proportional among the regions. In addition, the variable allowance program does not shift any wealth away from polluters to the government, and any redistribution of wealth between regions or between polluters can be compensated for in the initial allocation of rights.

Conclusion

Economists and others who pursue market-based approaches to environmental regulation must understand all the features of the pollutant whose emissions they are attempting

to control. Some pollution problems cannot be easily solved by blindly relying on the market, and some market-based approaches are not suitable for some pollutants.¹⁵⁹

In applying a traditional marketable rights program to the regulation of sulfur dioxide, Title IV has failed to take into account the local impact that sulfur dioxide-induced pollution causes. By charging all polluters the same amount to emit sulfur dioxide, even though the social costs of that pollution vary according to where it is emitted, Title IV is inefficient. Consequently, certain areas will be faced with more pollution, and others with less pollution, than they would under an ideal program.

This paper has identified three potential solutions to this problem: a regional marketable rights program, a combined marketable rights/emission fee program, and a variable allowance value program. Each program adjusts the cost of polluting to better reflect the actual damage that each polluter's emissions cause, while still maintaining economic incentives to motivate polluters to reduce pollution.

Most important, one of these representative programs should be applied whenever a pollutant has the same characteristics as sulfur dioxide. That is, these programs are suitable for pollutants which have both a national and regional impact. Each program uses a marketable rights program to allow trading between firms, which lowers the total costs of pollution control. However, at the same time, each increases the cost of polluting in regions where pollution causes the most damage; thus, all else being equal, an incentive exists to locate in less socially costly areas.¹⁶⁰

Although reworking Title IV's emission trading program may cause more harm than benefit, this analysis should allow policy makers to recognize the limitations of a traditional marketable rights program, and thereby avoid similar mistakes in the future. To this end, Congress should make it standard policy that the EPA, before designing a market-based pollution control program, conduct an informal study to determine whether, and to what degree, a uniformly mixed pollutant has local effects.

¹⁵⁹ For example, in situations where only a few polluters operate, no liquid market for the rights would exist; see *supra* text accompanying notes 140-52. In other situations, the accounting and monitoring costs of regulation in a marketable rights program would exceed its benefits. Regulation of emissions from lawn-mowers might be a good example of such a situation. Krier Lecture, *supra* note 77.

¹⁶⁰ Indeed, by not allowing intra-regional trades, the regional marketable rights program increases this cost to infinity.

