CAP AND TRADE: HOW THE SULFUR DIOXIDE ALLOWANCE MARKET WORKS, AND HOW IT COULD WORK BETTER

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INTRODUCTION

Suppose two people both owned money making machines. Person A's machine consumes one emission allowance at a time and generates $275. Person B's machine consumes one allowance and generates $300. Wouldn't we want our legal system to remove any obstacles that would prevent Person A from selling his allowances to Person B?

The capital gains tax presents just such an obstacle to firms that participate in the market for sulfur dioxide emissions allowances. Since firms that are allocated allowances by the government don't have to pay for them, the allowances are recorded as having a cost of zero dollars. This means that the first time an allowance is sold, the firm selling it has to pay capital gains tax on the entire sales price. This can prevent firms that are allocated allowances from selling them to other firms that could put them to better use.

The cap-and-trade program established by Title IV of the Clean Air Act is based on a pragmatic idea. Since a certain amount of pollution is inevitable, the program aims to (1) keep pollution to a reasonable level and (2) make sure that society gets the most benefit out of each ton of pollution emitted. The overall cap on emissions ensures that the first condition will hold, while the efficient operation of the market is supposed to provide the second.

If the market is not operating efficiently, it means that some firms are emitting sulfur dioxide even though other firms could get more value out of the same amount of emissions. It also means that the market is not providing observers with accurate information about abatement costs-neutralizing one of the useful side effects of the emissions market.

An inefficient market imposes unnecessary compliance costs on the power industry. To the extent that environmental regulations are restrained by the costs that regulations impose on industry, this will lead to unnecessarily lax emissions restrictions. Making the market more efficient will allow the imposition of tighter standards.

This Article attempts to provide an overview of the sulfur dioxide emissions market, with an eye for how it could be improved. This information can be used to improve the performance of the sulfur dioxide allowance market, or incorporated into new emissions allowance markets to improve their operation. Part I of this Article provides background information on the creation and operation of the sulfur dioxide emissions market. Part II reports and analyzes data regarding the actual behavior of the market from 1995 to 2003. Part III engages in an economic analysis of the interaction between the emissions allowance market and the power industry. Part IV then identifies and describes some barriers to efficient trading.

Finally, Part V will explore potential solutions to the problems caused by the capital gains tax. The capital gains tax makes selling allowances less desirable, and any solution to the problem must neutralize that effect. This Article will eventually suggest that charging a fee to companies that redeem never-traded allowances is the most practical solution.

I. BACKGROUND INFORMATION ON THE SULFUR DIOXIDE MARKET

A. The Clean Air Act Amendments of 1990

Congress passed several major amendments to the Clean Air Act in 1990. [1] The most innovative- and controversial- of these amendments was Title IV, which introduced a market based approach to controlling the pollutants that form the key components of acid rain: sulfur dioxide and nitrous oxide.[2] This Article will focus on the Act's treatment of sulfur dioxide and its consequences.

The key innovation of the sulfur dioxide program was that it created tradable emission allowances, subject to an overall cap.[3] This replaced the previous program, which mandated that all non-grandfathered utilities emit sulfur dioxide at a specified rate per million BTUs generated.[4] Under the system of emission allowances, a firm's sole obligation is to have sufficient allowances to cover its total annual emissions.[5]

This change in focus gives firms an economic incentive to reduce emissions as far as is practical, instead of simply reducing by the minimum necessary to comply with the law. Any reduction in emitted sulfur dioxide allows the abating firm to sell excess allowances on the private market, or avoid purchasing allowances in the first place.

Title IV implemented this cap and trade approach in two phases.[6] In Phase I (lasting from 1995 to 2000) only certain targeted power plants were subject to the cap.[7] Under Phase II, almost all power generating units must comply with the cap.[8]

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[1] *See generally* Brian L. Farrel, *The Clean Air Act Amendments of 1990 And the Use of Market Forces to Control Sulfur Dioxide Emissions*, 28 HARV. J. ON LEGIS. 235 (1991).

[2] 42 U.S.C. § 7651 (2004).

[3] *See* Jonathan Nash & Richard Revesz, *Markets and Geography: Designing Marketable Permit Schemes to Control Local and Regional Pollutants*, 28 ECOLOGY L.Q. 569, 582 (2001) (discussing the sulfur dioxide trading market).

[4] Or that they use a prescribed technology, which amounts to the same thing. See generally Bruce Ackerman & Richard Stewart, *Reforming Environmental Law*, 37 STAN. L. REV. 1333 (1985) (critiquing the then existing regulatory regime).

[5] 42 U.S.C. § 7651c-d (2004).

[6] *See* 42 U.S.C. § 7651a (28) (2004) (defining the beginning of Phase II).

[7] 42 U.S.C. § 7651c (2004). The list of targeted plants is in Table A of 42 U.S.C. § 7651c (e) (2004).

[8] 42 U.S.C. § 7651d (2004).

Phase I was marked by significant over-compliance.[9] The amount of allowances issued each year varied significantly, as utilities received bonus allowances for installing scrubbers and non-targeted firms' voluntary participation in the program varied.[10] However, total emissions were well under the cap every year.[11] Firms anticipated that allowances would become much more valuable under Phase II (as the number of emissions sources regulated would be dramatically increased without a corresponding increase the cap) and engaged in speculation by reducing emissions farther than the law mandated.[12]

By the time Phase II began, firms had banked more than ten million tons of sulfur dioxide emissions allowances.[13] They have drawn down on those savings in order to cushion the impact of the more stringent cap in Phase II.[14] This prevented the price of pollution allowances from skyrocketing as the program transitioned from Phase I to Phase II.[15] Under Phase II the EPA allocates approximately 8.95 million tons of emission allowances to firms for each vintage year.[16] The EPA also issues special allowances for various reasons,[17] and the total amount of emission allowances issued for each year has been about 9.5 million tons.[18]

Firms aren't limited to trading active (retireable) allowances, but may also trade future allowances. The EPA gives a firm that is allocated *X* tons of annual allowances *X* vintage-2000 allowances, *X* vintage-2001 allowances, *X* vintage-2002 allowances, and so forth.[19] Allowances can be retired to cover sulfur dioxide emitted in the year of their vintage, or banked and later retired to cover emissions for any year afterwards.[20]

The mechanics of the allowance system are simple. The EPA maintains an Allowance Tracking System, which tracks the ownership of all existing sulfur dioxide allowances.[21] Firms are required to report all allowance

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[9] The EPA maintains a computerized database tracking allowance retirement information. This statement is supported by data pulled from that database. I'm not sure exactly how to cite to this, so let's just say: hereinafter "EPA Retired Allowances Database."

[10] The rules regarding the variable credit allocations are specified in 42 U.S.C. § 7651c (b). The variable credit issuance itself is visible in the EPA Retired Allowances Database.

[11] EPA Retired Allowances Database.

[12] Byron Swift, *How Environmental Laws Work: An Analysis of the Utility Sector's Response to Regulation of Nitrogen Oxides and Sulfur Dioxide Under the Clean Air Act*, 14 TUL. ENVTL. L.J.309, 325 (2001).

[13] EPA Retired Allowances Database.

[14] EPA Retired Allowances Database; EPA Compliance Report 2002, page 2, *available at* http://www.epa.gov/airmarkets/cmprpt/arp02/2002report.pdf.

[15] EPA Compliance Report 2002, page 6 actually shows prices going down from the end of 1999 to mid-2000.

[16] 42 U.S.C. § 7651b (2004). Exceptions to this (bonus allocations) are discussed in 42 U.S.C. § 7651c (b) (2004).

[17] 42 U.S.C. § 7651d (a) (2), (a) (3) (2004) provide for bonus allocations.

[18] The existence of these excess allowances can again be seen in the EPA Retired Allowances Database.

[19] 42 U.S.C. § 7651a (3) (2004) provides that allowances are tied to a particular calendar year.

[20] 42 U.S.C. § 7651a (3) (2004) states that an allowance authorizes an emission "during or *after*" (emphasis added) a specified calendar year.

[21] The Allowance Tracking System is mandated in 42 U.S.C. § 7651 b (a) (1) (d) (2004).

transfers to the EPA, which then updates the Allowance Tracking System.[22]

The Title IV cap and trade program has been a success by any measure. Sulfur dioxide emissions in 2002 were down more than 40% from their 1980 levels (and down 35% and 14% from 1990 and 1995, respectively),[23] and these reductions have been achieved at a surprisingly low cost.[24] Of course, the system could still be made to work better.

B. Market Participants

Power generating companies directly own forty five percent of the allowances that have been banked from previous years.[25] Allowance brokers hold the vast majority of the remaining credits. Some of these allowances are being held for individuals, while some are being held for power companies (as it is easier for some firms to trade through brokers than to trade directly with other firms).[26] Power companies retired the vast majority of allowances that have been retired over the course of the emissions trading program,[27] and power companies own almost all of the allowances for future vintage years.

Accordingly, when this Article refers to participants in the sulfur dioxide allowances market, it is generally referring to power plants. While the behavior of outside investors and environmentalists is interesting, it does not have a noticeable effect on the market as a whole.

Power companies have been one of the most heavily regulated groups of companies in the United States ever since the collapse of several power generating pyramid schemes in the 1930s.[28] Many plants' top levels of management were and are comprised of a publicly elected board.[29] States have recently started to move towards deregulating power generation,

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[22] 42 U.S.C. § 7651b (a) (1) (d) (1) specifies that allowance transfers are finalized *after* they are recorded in the Allowance Tracking System.

[23] EPA Compliance Report from 2002.

[24] *See generally* A. Denny Ellerman et al., Markets for Clean Air: The U.S. Acid Rain Program (2000) (evaluating the impact of Title IV on sulfur dioxide emissions)

[25] EPA Annual Compliance Data, obtained from an EPA official. This might appear to be a low percentage. However, most firms that trade allowances will trade them through a broker, in the same way that most individuals who trade stock holdings generally trade through a broker instead of actually attempting to sell physical copies of stock certificates to other investments.

In addition, it makes sense that most of the allowances that are traded remain banked, rather than being retired. This is because of the tax treatment of allowances- an allowance that has been sold has a cost basis of its sales price, so that future sales of that allowance will incur less of a tax liability than would selling an allowance that has never been traded. Accordingly, a firm with a choice between the two will choose to retire the allowance that has never been traded.

Also, keep in mind that the currently banked allowances represent less than 10% of all of the 2003 and earlier vintage year allowances issued.

[26] Source: Interviews with EPA officials.

[27] EPA Retired Allowances Database.

[28] For a historical look at utility regulation, see 2 Alfred E. Kahn, The Economics of Regulation: Principles and Institutions (1971).

[29] See Lisa Heinzerling, *Selling Pollution, Forcing Democracy*, 14 STAN ENVTL. L.J. 300, 333 (1995) (discussing some of the obstacles that this regulation can create for allowances transactions).

which should have interesting side effects on plant participation in the market for allowances. Unfortunately, a full survey of the current state of the power industry is beyond the scope of this Article.

C. Summary of Available Pollution Reduction Methods

This section provides a brief description of the methods available to power plants to reduce their sulfur dioxide emissions. It's easier to predict how firms will behave when we understand some of the physical constraints under which they operate.

1. Use of Low-Sulfur Coal

Most coal-fired plants can retrofit their boilers to handle bituminous low-sulfur coal for a very low cost[30] (typically between $5 and $10 per kW of capacity). The main cost involved in switching to the lower sulfur coal is the increased cost of the coal itself.[31] Since bituminous low-sulfur coal (mostly from the east coast) is less common than high-sulfur bituminous coal, lower sulfur coals command a price premium.[32]

Since the market in emissions allowances began operating, sulfur content has become a factor priced in to the cost of coal.[33] Where the market was previously divided into "high sulfur" and "low sulfur" coal, the emphasis that the Clean Air Act put on making every ton of emissions count created a gradient of types of coals, with the price increasing as the sulfur content decreases.[34] Some plants were able to reduce sulfur dioxide emissions significantly simply by switching from high sulfur to medium sulfur coal.[35]

Switching to a lower sulfur coal is also the emission abatement method with the shortest lead time. While installing scrubbers takes eighteen to thirty months from the time that the installation decision is made,[36] firms can switch to low sulfur coal as quickly as they can renegotiate their fuel supply contract.

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[30] Swift, *supra* note 12, at 338.

[31] In 2003, low sulfur coal carried between an $.86 and $3.32 premium per ton of coal used. Energy Information Administration Annual Energy Outlook report, supplemental table 112, *available at* http://www.eia.doe.gov/oiaf/aeo/supplement/pdf/suptab_112.pdf (hereinafter Coal Price Report).

[32] *Id.*

[33] Swift, *supra* note 12, at 339.

[34] *Id.*

[35] Swift, *supra* note 12, at 337.

[36] Swift, *supra* note 12, at 331.

2. Use of Extra Low-Sulfur Subbituminous Coal

Subbituminous coal mined in the western United States has extremely low sulfuric content (at or below .6 lb/mmBtu, compared with 1.2 lb/mmBtu for Appalachian low-sulfur coal).[37] However, the nature of the coal makes it more difficult to burn than eastern bituminous coals, requiring more extensive retrofitting of existing plants (typically costing between $50 to $75 per kW of capacity).[38] The subbituminous coal is mined in large quantities from Idaho and Montana, so once the retrofit is complete ongoing costs are relatively minor.[39] This makes using this type of coal a sort of halfway step between switching to low sulfur bituminous coal and installing scrubbers.

In addition, some firms have experimented with burning mixes of subbituminous and bituminous coals.[40] This requires less extensive capital investment and still results in lowered sulfur dioxide emissions.[41]

3. Installation of Flue Gas Scrubbers

Flue gas desulfurization, or "scrubbing," is a technology that uses chemical reactions to remove sulfur dioxide from the smoke produced by a power plant before releasing it into the environment.[42] Scrubbers are expensive to install, but are cheap to operate once in place.[43] The low operating costs make scrubbers a good abatement solution for large plants, while the high installation costs make scrubbers impractical for smaller plants (unless the price of an allowance is very high).

Since the beginning of the cap and trade program, scrubber costs have been going down.[44] Improvements in scrubber technology have been driven by competition with other emission reduction methods and by the changed emphasis of the Clean Air Act.[45]

Under the previous regime, some firms were simply required to maintain a low rate of emissions per unit of power generated.[46] The only way to meet this standard was by installing scrubbers. Accordingly, scrubber manufacturers did not have to worry about plants switching to an alternative method of emission reduction. Under the Clean Air Act today,

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[37] Swift, *supra* note 12, at 336.
[38] Swift, *supra* note 12, at 336, 338.
[39] Sub-bituminous coal from the Powder Basin/Green River area cost only $7.09 per ton in 2003, compared with a price of $29 to $35 per ton for Eastern low sulfur coals. Coal Price Report.
[40] Swift, *supra* note 12, at 392-93.
[41] *Id.*
[42] Ellerman et al, *supra* note 22, at 241-242.
[43] *Id.*
[44] Swift, *supra* note 12, at 332.
[45] Swift, *supra* note 12, at 333-34.
[46] See Swift, *supra* note 12, at 334.

of course, this is no longer the case.

The pre-1995 Clean Air Act also enacted heavy fines for any violation of the rate restrictions.[47] This meant that scrubbers had to be extremely reliable, which lead to excessive built in redundancy.[48] Under the cap and trade program, companies that build scrubbers focus on removing as much sulfur dioxide as possible as cheaply as possible.[49] The removal of excess redundancy has helped to lower the installation and operating costs associated with scrubbers.[50]

4. Reduction in or Relocation of Electricity Generation

Firms can always reduce emissions by reducing the amount of electricity that they generate. This can be a very expensive proposition, especially for plants that are already using relatively clean power generation technology.

One cost effective way of reducing emissions is to relocate electricity generation. Several firms have reduced their total emissions by reducing the amount of electricity generated at smaller, dirtier plants and making up the difference at larger plants that use clean power generation technology, like scrubbers.[51]

II. OBSERVED BEHAVIOR IN THE PRIVATE ALLOWANCE MARKET

The data in this section come from an electronic database maintained by the EPA that tracks allowance retirement. I have used standard database tools to aggregate and separate out useful information.

Caution must be exercised when drawing conclusions from this data. Because the market in Phase I was so different from the market in Phase II, we really have two separate data sets of five years and four years, respectively. Five years of data are not enough to allow us to claim strong statistical inferences. This Part will only use the data to add support for theories about how the market works, or to reject theories that are clearly contradicted by the observed data.

A. Price and Emission History

1. Phase I

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[47] Swift, *supra* note 12, at 334.
[48] *Id.*
[49] Swift, *supra* note 12, at 335.
[50] *Id.*
[51] Swift, *supra* note 12, at 333.

a. Tracking Total Emissions

The first four years of the sulfur dioxide market system were marked by reduction far beyond the minimum cap requirements. The following table describes the number of allowances available and the number of allowances retired each year:[52]

	1995	1996	1997	1998	1999
Issued	8772768	8265104	7101605	6952813	6148527
Previously Banked	0	3844456	6808699	8468757	9968627
Total Available	8772768	12109560	13910304	15421570	16117154
Total Retired	4928312	5300861	5441547	5452943	5359147

After a slight jump from 1995 to 1996 the number of allowances being retired each year remained fairly constant at a level well below the number of allowances issued each year. Because of this, a large number of allowances built up in the bank. We can see from the table that the large number of allowances in the bank did not lead to more sulfur dioxide being emitted.

The following table compares the prices of emission allowances (in nominal dollars) from year to year:[53]

	1995	1996	1997	1998	1999
January Price	140	100	100	100	210
July Price	135	75	90	200	190
December Price	100	100	100	210	130
Allowances Retired	4928312	5300861	5441547	5452943	5359147

As Part III explains, economic theory would predict an inverse relationship between the price of an allowance and the amount of sulfur dioxide emitted. This table provides some support for such a theory, or at least does not contradict it. As prices stayed constant (declining slightly in real value due to inflation) emissions showed only a slight increase, while the year after the prices went up less of sulfur dioxide was emitted. The abnormally low amount emitted in 1995 is probably due to the fact that the consensus estimate before the start of the cap and trade program for the price for a one-ton emission allowance was around $300.[54] Firms had made

[52] EPA Retired Allowances Database.

[53] Retirement volume is from EPA Retired Allowances Database. Market prices pulled from the 2002 EPA Compliance Report.

[54] Swift, *supra* note 12, at 331.

plans and installed equipment based on that number that led to low emissions in 1995 and, to a lesser extent, in 1996.[55]

This table also suggests that firms do not react quickly to changes in price. While prices shot up in 1998, sulfur dioxide emissions didn't start to go down until 1999.

b. Tracking Autarchic Behavior

Phase I was also marked by heavily autarchic[56] behavior. That is, firms met most of their emissions obligations by retiring allowances that had originally been allocated to them, rather than by retiring allowances that they bought from a different firm. The following table measures such behavior:[57]

	1995	1996	1997	1998	1999
Total Retired	5359147	5452943	5441547	5300861	4928312
Autarchic Allowances	4190664	4054370	3720455	3709535	3499133
Autarchic Percentage	78.2	74.4	68.4	70	71

This shows, for example, that in 1995, of the 5.36 million allowances retired, 4.19 million were retired by the same firm to which the government initially allocated them. The percentage of allowances retired in this matter went down over time, but never dropped much below seventy percent. This means that seventy percent of the allowances used each year were never traded on the open market. In turn, this means that the price generated by the market was based on trades involving the other thirty percent.[58]

c. Tracking Retirement by Vintage

Emission allowances are issued with a particular vintage year.[59] Allowances with a vintage of year *N* can be used to cover emissions for year *N* or for any year afterwards, but can not be used to cover emissions liability for years before *N*.[60]

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[55] *See id.*

[56] Autarchy is defined by Merriam-Webster as a policy of self-sufficiency and independence. In this context, a firm behaves autarchically when it complies with emissions requirements by using its own allowances- that is, without trading on the market. Autarchic allowances are those allowances retired by the firm to which they were originally allocated.

[57] EPA Retired Allowances Database.

[58] Or by trades involving allowances that were banked for future use. Unfortunately, data on the ownership of banked allowances is not readily available. This is ameliorated to a certain extent by the fact that banked allowances are counted (as either autarchic or non-autarchic) when they are eventually retired- the current total of 7.7 million banked allowances represent only 10% of 2003 and earlier vintage allowances.

[59] 42 U.S.C. § 7651a (3) (2004).

[60] *Id.*

This table tracks vintage retirement rates by year:[61]

		Retirement Year				
Vintage	**Issued**	**1999**	**1998**	**1997**	**1996**	**1995**
1995	8772768	65719	209298	619389	1486242	5359147
1996	8265104	306111	963555	1882966	3966701	
1997	7101605	698802	1359827	2939192		
1998	6952813	1212504	2768181			
1999	6148527	2645176				

This table shows, for example, that 1,486,242 vintage-1995 allowances were retired in 1996.

There is a consistent pattern of firms redeeming banked allowances from past years, even as they are banking allowances from the current year at a tremendous rate. This probably results from firms treating allowances as interchangeable once they can be retired to cover emissions obligations.[62]

2. Phase II

a. Tracking Total Emissions

Phase II of the sulfur dioxide trading program involved many more sources of pollution, while the cap on the number of allowances issued each year remained about the same.[63] In addition, there was no longer any reason to hoard credits- firms did not expect a dramatic increase in future demand in the way that they expected demand to increase from Phase I to Phase II.[64] Accordingly, companies began to retire some of their banked credits:[65]

	2000	**2001**	**2002**	**2003**
Issued	9879565	9547229	9535636	9535906
Previously Banked	10758007	9595332	8512731	7855376
Total Available	20637572	19142561	18048367	17391282
Total Retired	11042240	10629830	10192991	10577783

[61] EPA Retired Allowances Database.
[62] As, in fact, they are, per 42 U.S.C. § 7651a (3) (2004).
[63] 42 U.S.C. § 7651d details the additional utilities covered under Phase II (compared with the table of affected units in Phase I in Table A at 42 U.S.C. § 7651 c (e). The constant level of allowance issuance can be seen in the EPA Compliance Report for 2002.
[64] Though this may change, if the Clear Skies Act, S.1844, 108th Cong. (2003) passes, as it would dramatically reduce the number of available allowances, as documented in § 43.
[65] EPA Retired Allowances Database

Again, we can see that the number of allowances retired each year do not correlate well with the total number of allowances available to be retired. If there were a strong relationship between existing allowances and total emissions then we would not see emissions change in different directions from year to year (down from 2000-01 and 2001-02, and up from 2002-03) while the number of available allowances steadily decreased. We must look elsewhere for an explanation of firms' behavior.

The table comparing emission allowance prices (in nominal dollars) with total emissions shows a correlation:[66]

	2000	2001	2002	2003
January Price	130	160	170	140
July Price	150	200	150	170
December Price	160	170	140	210
Total Retired	11042240	10629830	10192991	10577783

We see again that lower beginning of year allowance costs lead to lower overall emissions. We also again see a delayed reaction to price inputs- although allowance prices were falling throughout 2002, firms didn't start emitting more sulfur dioxide until 2003.[67]

b. Tracking Autarchic Behavior

Autarchic behavior was less prevalent in Phase II than it was in Phase I, but remained common:[68]

	2000	2001	2002	2003
Total Retired	11042240	10629830	10192991	10577783
Autarchic Allowances	6485185	6465461	6272849	6293865
Autarchic Percentage	58.7	60.8	61.5	59.5

The proportion of allowances retired by their original owners has remained fairly close to sixty percent throughout Phase II. This is ten percentage points lower than the autarchy rate observed during Phase I. This is probably due to some change in the makeup of the market from Phase I to Phase II. It's possible that the larger number of participating firms led to a more efficient market, leading to less hoarding and more use of externally acquired credits.

[66] EPA Retired Allowances Database.

[67] Editors: there is a chart in the EPA Compliance Report for 2002 on page 6 that provides more solid support for this statement. I hope to get permission to reprint it here.

[68] EPA Retired Allowances Database

Another explanation focuses on the existence of intra-firm trading. Allowances are allocated on a plant-by plant basis. Since many firms own multiple plants, they may choose to move allowances from a clean plant (or a plant that is easier to make clean) to a dirty plant. Firms could accomplish the same thing indirectly by reducing power production at their dirty plants and increasing it at their clean plants. Taking advantage of these sorts of opportunities allows firms to avoid using the market without sacrificing too much efficiency.

Small firms don't have this option. Firms that own only one or two plants must use the market. If their plants are clean, they have to use the market in order to get any benefit from their excess allowances. If their plants are dirty, they have to use the market in order to obtain allowances to cover their emissions obligations. Since Phase I only involved certain targeted plants,[69] while Phase II covers all coal fired power producers,[70] it seems reasonable to believe that Phase II simply includes more small firms that do not have the option of autarchic compliance.

c. Tracking Retirement by Vintage

It can also be helpful to break down each year's retired allowances by their original vintage, to get some idea of the magnitude of the inter-temporal trading[71] going on. Remember, an allowance may be retired to cover an emission obligation at any point after its vintage year, but not before.[72] Here is the table:[73]

		Retirement Year			
Vintage	**Issued**	**2003**	**2002**	**2001**	**2000**
1995	8772768	66055	143697	109105	470358
1996	8265104	99958	220855	308151	387309
1997	7101605	176799	307517	552628	838757
1998	6952813	174192	460568	708858	1152455
1999	6148527	366770	682957	782897	1915984
2000	9879565	389769	595248	1746575	6277377
2001	9547229	727742	1404220	6421616	
2002	9535636	1754162	6377929		

[69] As enumerated in 42 U.S.C. § 7651c (e) Table A.

[70] As described in 42 U.S.C. § 7651d (a) (1), and elaborated upon at great length in § 7651d (b), (c), (d), (e), (f), (g), and (h).

[71] Economists often refer to banking as intertemporal trading (as in the working article by A. Denny Ellerman and Juan-Pablo Montero, *The Temporal Efficiency of SO2 Emissions Trading*, available at http://www.mit.edu/afs/athena/org/c/ceepr/www/2002-003.pdf). The idea is that a firm is essentially trading an allowance from its past self to its future self. The lay person might refer to this as "saving," which simply shows a lack of appreciation for the insight that one acquires with a PhD in Economics.

[72] See 42 U.S.C. § 7651a (3) (2004).

[73] EPA Retired Allowances Database.

2003	9535906	6822336			

This table shows that throughout Phase II firms have banked allowances from the current year while retiring allowances from previous years. This provides more documentation for the tendency we saw in Phase I for firms to treat retireable allowances of different vintages as interchangeable.

B. Autarchic Behavior

1. Breakdown of Sources of Retired Credits

This section will examine the sources from which firms obtained allowances to cover their emissions liabilities. This analysis does not consider the total trading volume in the market- it considers the number of unique allowances that were ever traded on the market. The year-by year results are in the following table:[74]

Year	Credits Retired	% Autarchic	% Aut. Same Yr.	% Aut. Prev Yr.
1995	5359147	78.2	78.2	0
1996	5452943	74.4	55.5	18.9
1997	5441547	68.4	45.4	23
1998	5300861	70	43	27
1999	4928312	71	46.3	24.7
2000	11042240	58.7	46	12.8
2001	10629830	60.8	47.3	13.5
2002	10192991	61.5	48.8	12.8
2003	10577783	59.5	47.1	12.4

This table gives the total number of allowances retired each year, and the percentage of them that were redeemed by the same firm to which they were originally allocated. It then breaks the autarchic allowances into two categories: allowances with a vintage year the same as the year that they were redeemed, and allowances from a previous vintage.

A certain amount of autarchic behavior is inevitable. After all, the firms that have had credits allocated to them will continue to produce power, and will emit a certain amount of sulfur dioxide. It is perfectly reasonable for them to hold back a certain amount of allowances to cover those emissions.[75]

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[74] EPA Retired Allowances Database.

[75] In addition, we would expect firms to favor retiring untraded allowances over traded allowances, for tax reasons. *See infra* note 25.

However, we should still look for systemic incentives that prevent firms from selling all of the allowances that they would sell in an efficient market. Under ideal conditions, the initial allocation would be irrelevant- given low transaction costs, emission allowances would find their way to the high cost avoiders.[76] However, as will be discussed in section IV, there are several reasons to believe that conditions are not ideal and that firms are not reducing emissions in the most efficient possible manner.

For now, it is worth noting the high percentage of allowances that are never available on the market (although it is possible that some of the credits marked as autarchic within the table above had actually been sold and then purchased back by the original firm, it is unlikely given the capital gains tax that would be incurred by such a transaction). Apparently, while annual trading volumes were high,[77] that volume consisted of a relatively small number of allowances being traded back and forth.[78]

2. Strange Banking Behavior

Another fact apparent in the table above is that a significant number of the never-traded allowances that firms retired had been carried over from the previous year. This is counterintuitive- if a firm reduced its emissions sufficiently to carry some of its allotment over into the next year, it would be a little surprising to see them have to tap into that bank the next year. However, we saw from the table in II.A.1.c that firms do not collectively retire all of the current year's allowances before beginning to retire allowances from previous years. Accordingly, some firms were probably just retiring allowances from the previous year while banking allowances from this year.

What is odd is that firms carry around excess allowances in the bank in the first place. Once a firm has reduced its annual emission total below its annual allowance allocation, it does not have any pressing business need to keep the extra allowances around. Even if the cap were overly lenient, leading to a lot of excess allowances, it doesn't make sense for power generating firms to be the ones holding on to the extra allowances. Holding on to them is pure financial speculation.[79]

This behavior could be motivated either by a widespread belief within

[76] This is a fairly straightforward application of Coase's Theorem, as developed in Ronald Coase, *The Problem of Social Cost*, 3 J.L. & ECON. 1 (1960).

[77] 30.8 million allowances were traded between unrelated entities, according to Swift, *supra* note 12, at 341.

[78] Again, the unique credits being traded around could include those that were banked at the end of each year. However, such allowances must eventually be retired and thus recorded as either autarchic or non-autarchic. The number of currently outstanding (banked and therefore non-classified) allowances represent only 10% of the total number of 2003 and earlier vintage allowances issued.

[79] In an analogous situation, airlines keep a certain amount of oil (and options to purchase oil in the future) in reserve (as their business is highly sensitive to changes in the price of oil). However, airlines do not hold amounts beyond that needed to protect their core business.

the industry that prices are going up or by inefficiencies within the market. The idea of widespread belief in a price increase doesn't make sense- if everybody thought prices should be higher, then prices would be higher. Accordingly, we should examine the market to identify factors that could be creating inefficiencies. But first, we should establish a framework for understanding the market so that we can recognize problems when we see them.

III. MODELING THE INTERACTION BETWEEN THE ALLOWANCE MARKET AND FIRM BEHAVIOR

The goal of this part of the Article is to provide a framework for understanding the behavior of participants in the sulfur dioxide emissions market. Most of this analysis should also be applicable to other types of emissions trading markets, allowing for differences in costs and types of abatement technology.

The first section discusses the ways that the market can affect the emissions behavior of power plants. This becomes important in Part V as we explore how market participants' behavior will change given various possible changes in the rules for how the market works.

The next section examines the way that real world constraints affect the market price of allowances (and thus, emissions levels). It will do this by attempting to model the supply and demand curves that are driving the market. I make no claims to any sort of precision in deriving these curves. However, even a vague idea of the shape of the demand curve helps to constrain our predictions about the future to a plausible range and gives us a valuable starting point for figuring out how new rules and technologies could affect the behavior of the market.

A. Market Effects on Power Plant Behavior

Many articles have been written about the ways that the Clean Air Act has modified polluter behavior. The Act does so, of course, through the market's influence on firms. This section will attempt to explain how firms react to changes in market prices.

1. Allowance Prices and Abatement Costs Drive Abatement Expenditures

Each firm on the market should abate emissions until the cost of abating another ton of sulfur dioxide is equal to the market price for a one-ton emission allowance. If the cost of the next ton of abatement were higher than the market price, then the firm should have purchased an additional allowance instead of abating the emission. Conversely, if the cost of the next ton of abatement were lower than the market price, then the firm with the low abatement costs should continue to abate pollution until it could no longer profit from doing so- that is, until the marginal costs lined up.

This relationship is complicated by the real world issues associated with the use of an allowance. Since the firm doesn't have to settle up its account with the EPA until the end of the year, they have to guess what the future value of an allowance will be when making their decisions regarding emissions. Although the current price would reflect the best estimate of the future price in an efficient market, the actual market in allowances does not seem to be that efficient- looking at the historical prices of allowances, they jump around a lot more than we would expect if market participants were good at predicting the future.

Additionally, firms are not able to change their sulfur dioxide emissions instantly in response to changes in market price. Switching to lower sulfur coal may be delayed by the existence of a long term supply contract, while other methods of emission abatement (such as the installation of scrubbers) require long term capital improvements to the plant.[80]

The other factor that could cause firms to fail to comply with this principle is that some of them simply might not be rational profit-maximizers. The next Part will examine this issue in more detail.

2. Allowance Prices and Profits Derived From Emissions Drive Emissions Decisions

Firms should also continue emitting sulfur dioxide until the profit they gain from emitting another ton is less than the market price for an allowance. If the market price is below the value of the next ton of emissions, the firm should emit sulfur dioxide until it is no longer worthwhile to do so- that is, until the prices matched up. If the price is above the value of the next ton of emissions, then the firm should have refrained from emitting the previous ton of sulfur dioxide and instead sold (or refrained from purchasing) the associated allowance.

This is simply the converse of the abatement-price relationship described above. This reframing is most useful when considering the options facing a new firm. A modern, clean power plant can generate a lot of electricity for each ton of sulfur dioxide that it emits.[81] This would lead the owners of the firm to place a very high value on emission allowances. This helps to explain why new plants have not had as much trouble

[80] Swift, *supra* note 12, at 331.

[81] Among other things, a new plant faces a lower marginal cost to install clean technology when compared to an old plant that has to pay for a retrofitting (just as it is cheaper for a more powerful engine to be installed by a car manufacturer than it is for you to replace the engine that came with the car with something more powerful).

obtaining allowances as some predicted.[82] They just naturally place a higher value on the allowances than do firms that own older plants, which means that they will be willing to pay the market price for allowances.

3. Options Availability Gives Firms More Choices

Several brokerages offer options contracts for pollution allowances. These options prices generally conform to the Black Scholes formula[83] for valuing options. This allows power plants to specify an exercise deadline and strike price to a broker who will then figure out the appropriate price to charge for the option.

The existence of the options market gives firms an alternative method to limit their future allowance costs. For example, a firm that usually emits (and is allocated allowances to cover) one thousand tons of sulfur dioxide per year could buy one thousand call options with a strike price $10 above the market price and an expiration date one year in the future. The firm could then sell the one thousand emission allowances that it was allocated for that year. The firm can then use the money from this transaction to benefit the firm for a year before re-purchasing the allowances. The call options guarantee that they will not have to pay more than $10 above the current market price when the time comes to cover their emissions obligation.

4. Non-Polluters Participate for Investment or Idiosyncratic Reasons

A small portion of market activity comes from individuals and firms that do not emit sulfur dioxide. These individuals can generally be divided into two groups: environmentalists and investors.

Environmentalists purchase allowances in order to retire them without emitting any corresponding sulfur dioxide. By doing so, they reduce the total amount of sulfur dioxide that can ever be emitted under the cap and trade program. They also have the effect of reducing the supply of allowances available to the rest of the market, which in theory would result in higher prices and immediately lower the amount of sulfur dioxide emitted. However, the relatively tiny volume of such purchases renders any such effect practically invisible.

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[82] See Heinzerling, *supra* note 29, at 331 for an example of concerns about the effects of allowance allocation on new entrants into the market. An unpublished paper by EPA employees Reid Harvey, Joe Kruger, and Bill Irving, *U.S. Experience with SO2 and NOx Allowance Allocations* (9/12/2003), documents the lack of an observed barrier to new entrants beginning on page 9.

[83] The basic idea is that given the current price of an asset, the asset's volatility, the exercise price of the option, the date on which the option expires and the prevailing interest rate, a broker can calculate the correct price for an option. The more financially adventurous can peruse Fischer Black and Myron S. Scholes, *The Pricing of Options and Corporate Liabilities*, 81 Journal of Political Economy 637-654 (1973).

The other group consists of outside investors who buy allowances when they perceive them to be undervalued, and sell when they perceive them to be overvalued. In sufficient volume, these investors could act as an important source of efficiency- both in terms of making the market operate more efficiently by making it easier to match buyer and seller, and by keeping power companies in check through providing an independent source of estimates about the future value of allowances. However, outside investors also participate in the market at such low volumes that they have only negligible effects on the market.

5. Drawing Conclusions

These relationship discussed in subparts one and two is useful, but limited. Given the cost of the last ton of pollution abated, we can determine the correct price of a pollution allowance. Conversely, given the price of a pollution allowance, we can deduce the cost of the last ton of pollution abated. However, this does not tell us what the price of an allowance should be (or, equivalently, at what price per ton companies should stop paying for pollution abatement). In order to determine the correct price to put on a one-ton emission allowance, we must turn to an analysis of the supply of and demand for emission allowances.

B. Technology and Expectations Affect the Market

Since we know the real world constraints that power companies operate under, we can estimate the supply and demand for emissions allowances. However, the market for allowances is different from the norm. The government introduces 9.5 million tons' worth of credits into the market every year, regardless of the existing market conditions.[84] Since we know that not all outstanding allowances are retired each year,[85] the supply curve must be generated by something besides the total existing number of allowances.

The best way to model the market for pollution allowances is to treat power plants as both suppliers and consumers of allowances. We can think of a plant as having a separate "allowance holding" division and "sulfur dioxide emission" division. Presumably firms would only decide to transfer allowances between divisions when it is worth more to emit sulfur dioxide and retire the allowances than it is to continue to hold on to the allowances. Accordingly, we will treat "demand" as the demand for allowances to retire

[84] 8.9 million tons are mandated to be allocated by 42 U.S.C. § 7651b(a) (2004), and the various bonus allowances (whose issuance does not depend on market conditions) are described in 42 U.S.C. § 7651d (a)(2) (2004) and § 7651d (a)(3) (2004).

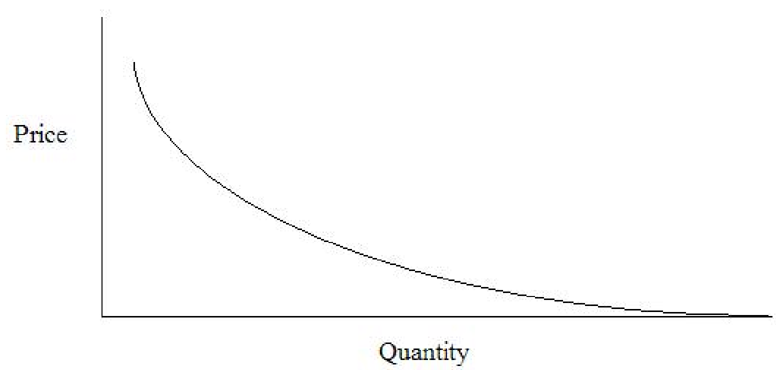
[85] As is visible in the EPA Retired Allowances Database, as well as in the table *infra* at II.A.2.a.

by the "sulfur dioxide emission" division, and supply as the willingness of the "allowance holding" division to give up allowances.

1. Demand

The demand for pollution allowances (to be retired to cover the year's emissions) corresponds to the marginal abatement costs at various price points. That is, the demand for emission allowances at a price of $700 is equal to the amount of emission that costs more than $700 to abate. Equivalently, the demand for emission allowances at a price of $300 is equal to the total amount of emissions such that each ton emitted brings in more than $300.

Since we know the cost and effectiveness of various forms of pollution abatement, we can approximate the shape of the demand curve:



At low prices demand is very flexible. The curve starts at the point on the graph representing the quantity of sulfur dioxide that companies would emit if there were no restraints on emissions. Once the cost of emission is above zero, companies will take simple measures to reduce pollution. These measures can include routine maintenance or switching to lower sulfur coals.

At moderate prices, the curve is less flexible. At this point companies will begin to make capital improvements in order to reduce pollution. This can include modifying boilers to accommodate subbituminous coal or installing pollution scrubbers.[86] These measures start to become cost effective at prices between $200 and $700 per allowance.[87]

At high prices the demand curve becomes very inflexible. At these price points, all of the technological measures for reducing emissions have

[86] See Swift, *supra* note 12, at 332 (discussing scrubber costs).
[87] See Swift, *supra* note 12, at 331.

been exhausted. The only way to reduce emissions further is to reduce energy generation. This is very costly- since plants would have already installed emission reduction technology, they would have to reduce electricity generation by a lot in order to appreciably reduce sulfur dioxide emissions.

2. Supply

The supply curve represents allowance holders' willingness to sell (or to retire) emission credits. It essentially represents a composite of all market participants' guesses as to what the price of an allowance should be, based primarily on what they think allowances will be worth in the future. The slope of the supply curve depends on the differences between different participants' estimates of the proper value. If the estimates are close together, then the curve will be very inflexible. If the estimates are far apart, then the curve will be flexible.[88]

In any event, the supply curve will move around a lot, since it depends so heavily on predictions about the future. There are many potential new events that can significantly change investors' outlooks on the future.[89] These can cause significant changes in the price of allowances.

3. Demand Outlook

The future outlook for demand for allowances depends on how much sulfur dioxide firms will choose to emit in the future at various price points. The main factors affecting their choices are (1) how much they can earn for each unit of electricity produced; and (2) the costs of technological methods of emissions reduction.

a. Technological Improvements in Abatement Methods

As abatement technology improves, the cost of reducing pollution will go down. This would cause the entire demand curve to shift down and to the left, reducing both the price of pollution allowances and the amount of pollution emitted (assuming the supply curve is held constant).

Technological advances can be difficult to predict. We have already

[88] The basic intuition behind this is that if people's guesses are all very close together, small shifts in price won't change the amount supplied (since there won't be too many people who won't sell at P1 but will sell at P2). If guesses are different, the number of people whose decision is changed by the same change in price increases. This makes the supply curve more flexible.

[89] One example is the rules change promoted by the EPA that would devalue future allowances. Interstate Air Quality Rule, 69 Fed. Reg. 4566, 4630 (proposed Jan. 30, 2004) (to be codified at 40 C.F.R. pt. 51, 72, 75, and 96). The more likely such a change appears to be, the more dearly suppliers will hold on to existing allowances.

seen some emission reducing methods come into being that were not predicted before the program began. The reduction in scrubber costs was unexpected,[90] as was the extensive use of subbituminous coal.[91]

b. Increased Demand for Electricity

Increased demand for coal-produced electricity would make producers want to generate more electricity at any given cost. This would shift the demand curve up and to the right. This would make pollution allowances more expensive and lead to more sulfur dioxide emissions. As the population increases and the economy grows, demand for electricity will naturally increase.

A relative increase in the costs of other methods of producing electricity (such as an increase in the price of oil) will lead to additional demand for electricity from coal-fired generators, and an associated increase in allowance price and emissions. This could cause demand for emission allowances to change more quickly than overall demand for electricity.

c. Future Direction for Demand

It's hard to assess which force will be dominant in the long run. The key issue is whether increasing demand will move the curve until the inflexible portion is above the annual cap. Is this were to happen, the price of allowances would rise significantly.

While we don't know which force (technology or increasing demand) will win out, there are reasons to believe that industry participants may overestimate the chances of a demand crunch. The pressure of increased demand for electricity is easy to see and predict, while technological progress is always difficult to anticipate. Combined with the inherent conservatism of power plant management, this could lead to a systematic overvaluation of allowances.

4. Supply Outlook

a. Recent Price History

Recently, the price of sulfur dioxide emission allowances has jumped through the roof. The price of an emission allowance on April 1, 2004 was $272.[92] By June 2nd the price was $375,[93] and by July 1st the price was

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[90] Swift, *supra* note 12, at 332.
[91] Swift, *supra* note 12, at 392-93.
[92] Editors: this information is pulled from the Cantor-Fitzgerald web site (http://www.emissionstrading.com) and requires that the user register and navigate through some search forms. I am not sure how to cite this info.

$425.[94] Since it seems unlikely that the demand for emissions moved so dramatically over a four-month span, something probably happened to change suppliers' outlook on the future value of emissions allowances.

Two factors stand out as contributing to this change in price. First, there was a general increase in oil prices in the first half of 2004. This increase made coal power more attractive. To the extent that investors believed this increase to be permanent, they would become much less willing to part with emissions allowances. The other factor affecting the price of emissions allowances springs from a rule proposed by the EPA in January.[95]

b. The Unintended Consequence of Devaluing Future Allowances

The Interstate Air Quality Rule proposed by the EPA calls for a dramatic reduction in the sulfur dioxide emissions cap starting in 2010.[96] The basic proposal is to require firms to use more than one allowance for each ton of sulfur dioxide emitted.[97] The devaluation would not apply to allowances that have a vintage year prior to 2010.[98]

Devaluing future allowances while leaving current allowances untouched makes current allowances more valuable. In a manner similar to firms' behavior under Phase I of the program, firms may start hoarding Phase II credits for use (or sale) when they are more valuable under the more stringent regime. The current market price for allowances may reflect the market's guess as to the likelihood of the Interstate Air Quality Rule's enactment as much as it represents anything else.

IV. Obstacles to the Efficient Operation of the Market

This section explores some features of the existing market in sulfur dioxide allowance that should be fixed. In order to recognize problems we must first separate out the good features of the market from the bad. The first section of this part will describe what the market would look like in an

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[93] Also from http://www.emissionstrading.com

[94] Also from http://www.emissionstrading.com

[95] Interstate Air Quality Rule, 69 Fed. Reg. 4566, 4630 (proposed Jan. 30, 2004) (to be codified at 40 C.F.R. pt. 51, 72, 75, and 96). Now known as the Clean Air Interstate Rule. *See* 69 Fed. Reg. 28874. The comment period for the law ended on March 30, 2004. Interstate Air Quality Rule, 69 Fed. Reg. 4566, 4630 (proposed Jan. 30, 2004) (to be codified at 40 C.F.R. pt. 51, 72, 75, and 96). Hearings have been held on supplemental proposals to the rule. 69 Fed. Reg. 28874. Final action on the rule is scheduled for November. Unified Agenda, June 28, 2004, Environmental Protection Agency, 69 Fed. Reg. 38197. The Clear Skies Act in Congress was the first attempt to implement this standard- since it is now stalled, the EPA is attempting to enact administratively what the Administration failed to achieve legislatively. See *Id*.

[96] Interstate Air Quality Rule, 69 Fed. Reg. 4566, 4630 (proposed Jan. 30, 2004) (to be codified at 40 C.F.R. pt. 51, 72, 75, and 96).

[97] *Id.* at 4632. Specifically, the proposal is that (1) pre-2010 allowances may be used at a one-to-one ratio; (2) 2010 to 2014 allowances may be used at a two-to-one ratio; and (3) post-2015 allowances may be used at a three-to-one-ratio.

[98] *Id.*

ideal world (of course, the hypothetical world is not *so* ideal that all pollution has been eradicated). Any departure from that ideal is a problem. These problems are then divided into two groups: qualitative problems and quantitative problems.

Qualitative problems are problems whose effects are hard to quantify. We can identify them as undesirable features of the market, but the only solution is to eradicate them directly- we can't attempt to indirectly cancel out their effects, because their effects are unpredictable. The two examples of these types of problems explored here are the agency costs imposed by the divergence of power plant managements' interests and shareholder/ratepayer value, and the disruption caused by political meddling (or potential meddling) in the market.

Quantitative problems are problems whose effects can be quantified. Since we can figure out the effects of the problem relatively easily, we can develop a variety of ways to counteract these effects. The one example of this type of problem discussed here is the market distortion caused by the capital gains tax.

Part V will explore potential solutions to the distortion created by the capital gains tax.

A. The Ideal Emissions Allowance Market

The ideal emissions market is efficient. It is populated by rational profit-maximizing actors who all face the same market price. Property rights are secure- an allowance that entitles the holder to emit one ton of sulfur dioxide in 2015 is guaranteed to allow him to emit one ton of sulfur dioxide in 2015 or beyond, as he chooses.

An efficient market where everybody faces the same market price ensures that everybody will have the same incentive to abate emissions. What this means in turn is that everybody will abate emissions up to the same maximum marginal cost. This is important because if two people stop their abatement at different marginal costs, then society is spending more than it has to in order to reach the current level of emissions (if one participant emits a ton that would have cost him $251 to abate, while another participant spends $300 to abate one ton of emissions, then society has just wasted $49).

The requirement that all participants be rational profit-maximizers is just the next step of this reasoning. When confronted with the same incentive, not all people will react the same way. However, all rational profit-maximizers *will* react the same way when they are confronted with the same incentive. This helps to avoid the problem noted above where firms stop their abatement at different marginal cost levels.

Because the market price is heavily based on predictions about the future, it is possible to glean information (or at least power generating firms' best guesses at information) from the current price of an allowance. Ideally, the market price would give us a good guess as to the future direction of abatement technology development and future demand for electricity. If there is a chance that the government could interfere with the property right associated with an allowance, then that chance must also be priced in to its value. Pricing in the risk of government interference obscures the other, more practically useful, information that we would like to obtain.

In the ideal market, society spends the least possible amount of money to reach its chosen level of sulfur dioxide emissions (or, equivalently, it reaps the most possible benefit from the amount of sulfur dioxide that it emits). The ideal market also allows us to see at a glance the consensus estimate for future costs of abatement, and to make decisions based on that information.

B. Qualitative Problems with the Sulfur Dioxide Market

1. Institutional Characteristics of Power Companies

The structure of the power generation industry creates two different problems that impede the efficient operation of the market. One problem comes from the regulations controlling the disposition of any profits firms earn from trading allowance. The other problem stems from agency costs arising from the divergence of interests between power plant management and power plant shareholders (or ratepayers, who are often the equivalent of shareholders in the heavily regulated power industry).

Most power plants are locally regulated monopolies, and most local regulations classify costs associated with emission allowances as fuel costs.[99] This means that any profits or losses incurred as a result of allowance trading must be passed on to consumers.[100]

This rule weakens firms' incentives to make profitable trades. Since their only reward is ratepayers' gratitude, they will not be as aggressive as they would if the reward for success were money on the balance sheet. It also probably leads to a risk averse style of trading. Consumers will be more angered by an increase in power rates than they will be pleased by a similar sized decrease in rates.

Risk averse behavior by itself does not cause any problems in the operation of the market. Rational firms can buy or sell options to help

[99] Ellerman et al., *supra* note 22, at 193.
[100] *Id.*

protect them against the risk of an increase in allowance prices. However, the behavior observed above,[101] where firms stockpile excess allowances year after year, is not rational.[102]

One explanation for this behavior is that it is a manifestation of the divergence of interests between power plant managers and power plant owners. Holding on to a large number of allowances represents a large financial risk, as the value of allowance is very volatile. Changing the firm's holdings (by, for example, selling excess allowances and buying options to protect against an increase in allowance prices) would reduce the firm's financial risk.

However, exposing the company to the risk of holding excess allowances does not require that any particular person take the blame. Changing the firm's holdings would require one person to take action, and therefore responsibility. While he would reduce the firm's overall risk, his action could still lead to bad results. Since the trades have little upside (as any gain must be passed on to customers), but a potentially disastrous downside (as the trader could be seen as the sole person responsible for an increase in power rates), the wise bureaucrat will avoid taking action.

Inaction by power plant traders does impede the efficient operation of the market. When firms have a bias against trading, they don't turn their excess allowances into cash. This lack of direct feedback could cause them to pass up worthwhile abatement opportunities.

2. Political Interference in the Operation of the Market

As mentioned earlier, the Interstate Air Quality Rule proposed by the EPA calls for devaluing future emissions allowances (every two tons of 2010-2014 vintage allowances and every three tons of post-2015 vintage allowances will only allow firms to emit one ton of sulfur dioxide). If this rule were enacted, it would cause current allowances (which would not be devalued) to become much more valuable. There is some evidence that the mere possibility of this rule coming in to force has already caused allowances to increase in value.

We would like for the market price of an allowance to reflect participants' best guesses about future technological progress and future demand for electricity. When the possibility of political interference in the market arises, the price also inevitably reflects participants' guesses about

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[101] *Infra* page 16-17.

[102] This behavior is only rational if every stockpiling firm feels that rising allowance prices are a lead pipe cinch. But in an efficient market it is impossible for all of the participants to think that the market price is too low. Some person who thinks the price is too low will offer to buy somebody else's allowances for slightly above the market price. If all of the potential sellers think that the price is too low, they'll refuse to sell. So the buyer will have to offer more money. This will be repeated until a sale takes place, setting the new market price.

political outcomes. While that may be interesting, it is not helpful to observers who would like to know the approximate cost of reducing marginal emissions based on a stable cap.

This sort of action also poses a direct threat to the operation of the futures market. Futures markets can be very helpful in predicting the future value of commodities. When the government shows a willingness to step in and directly devalue future interests it deters investors from participating in the market.

This type of government interference in the market does not threaten the efficient operation of the market as regards abatement decision making. It will not prevent firms from trading until only the highest cost abaters are emitting sulfur dioxide. However, it does obscure important information that could be conveyed through the market price of an allowance.

Although the information that the market price could convey is valuable, it is also valuable to reduce pollution. Legislators may simply have to weigh which value is more important. Although it might be possible to achieve both goals (such as by committing to only reducing the cap through market transactions), a full exploration of that possibility is beyond the scope of this Article.

C. Quantitative Problems with the Sulfur Dioxide Market

1. The Capital Gains Tax

The capital gains tax[103] provides a clear example of a distortion of market incentives. While power plant agency problems and uncertainty about government interference in the market provide reasons that actors in the market may choose not to make economically beneficial transactions, the capital gains tax actually renders some economically beneficial transactions worthless.

Because emission allowances are given to firms for free, they are recorded as assets with a cost of $0.[104] This means that when a firm sells part of its initial allocation of credits, the entire proceeds of the sale count as capital gains (presumably long-term capital gains, as all allowances of all vintages should have been deposited in their owner's accounts by 2000). So a firm that sells part of its initial allocation of allowances receives only 85% of its value, as the other 15%[105] goes to the IRS. A simple example will suffice to show how this distorts firms' incentives.

[103] See Rev. Rul. 92-16, 1992-1 C.B. 15 (describing the tax status of allowances). Basically, allowances do not create taxable income when they are first given to firms, but they have a zero cost basis for the purpose of the capital gains tax when sold.

[104] *Id.*

[105] Editors: This is the current long term capital gains tax.

Consider Albert's coal-fired power plant. This plant has some unusual characteristics. When it is running flat out it generates one thousand tons of sulfur dioxide emissions per year. Albert can reduce these emissions, but at a gradually increasing marginal cost. Reducing emissions by one ton would cost him one dollar. Reducing emissions by another ton would cost him two dollars. In general, abating the *Nth* ton of emissions would cost Albert *N* dollars.

In both scenarios presented below, the price of a one-ton emission allowance is $50. The amount of allowances that Albert buys or sells will not affect the market price- he is a price taker.

In our first scenario, Albert has had one thousand emission allowances allocated to him for every vintage year until 2025. We would like to see Albert reduce his emissions by fifty tons. That would get him to the point where the marginal cost of reducing pollution by another ton ($51) exceeds the value that society has put on doing so ($50). However, Albert does not receive the full $50 in value for each ton of emissions that he abates. He receives $50 less the 15% capital gains tax, or $42.50. Accordingly, he will only reduce his emissions by forty-two tons- the point at which the cost to him of further reduction ($43) exceeds the benefit *he* receives by doing so ($42.50). This leads to Albert inefficiently over-emitting sulfur dioxide.

Albert's emissions level is inefficient because his emission decision is being driven by the fact that he has been allocated allowances. Compare his decision here with the decision of someone owning an identical plant (call him Bert) that has not had any allowances allocated to him.

In this scenario, Bert has to buy allowances to cover any sulfur dioxide that he emits over the course of the year. For each ton of pollution that he emits, he has to decide if it is more expensive to spend $50 for a pollution allowance, or to spend the money that it would cost to abate the pollution. It is clear that he will choose to abate pollution until the cost of abatement is over $50. This will lead him to abate fifty tons of pollution- a different amount than he would have emitted had he been allocated credits.

When different market participants do not all reach the same marginal costs of abatement, money is being wasted. In the previous scenario, a total of ninety-two tons of emissions have been abated. The efficient way to do this would have been for both Albert and Bert to abate forty-six tons.[106] Instead, Albert only abated forty-two tons, and Bert spent $47, $48, $49, and $50 to abate an extra four tons (instead of Albert spending $43, $44, $45, and $46). Society is worse off by $16, *and* has been presented with an artificially high cost of abatement- it appears that a price of $50 is required to induce ninety-two tons of abatement, when it should only require a

[106] Note that the efficiency springs from equalizing the marginal costs, rather than equalizing the amount abated. The two are only equivalent here because by hypothesis both of the plants involved are identical.

market price of $46.

The preceding analysis posits a world in which each market participant operates a single power plant. In the real world, of course, many participants own multiple power plants. However, this does not change the analysis. Since intra-firm trading is free, it is reasonable to think of a multi-plant firm as simply operating one really big firm, and to aggregate the abatement costs of all of the plants owned by a firm.[107]

Bert's scenario does suggest one way of getting around the problem of the capital gains tax- simply stop handing allowances out for free. If companies have to pay for each allowance that they use, they will indeed reduce their output to the efficient level. However, this would be a drastic step to take- at the current price of $600 per allowance,[108] and a cap level of approximately nine and a half million tons,[109] this would be a 5.7 billion dollar annual hit to the power industry. In any event, such a proposal would probably be politically impossible to implement,[110] so it would behoove us to come up with a more subtle way of achieving the efficient result.

V. FIXING QUANTITATIVE MARKET DISTORTION

This Part will explore potential solutions to the incentive distortion created by the capital gains tax. There are two key attributes to any good solution to this problem. First, it should equalize abatement incentives between firms that are allocated allowances and firms that are not. And secondly, it should be revenue neutral towards the power industry as a whole. This second goal should make the solution more politically viable, as it makes it less likely that the solution will be seen as either a giveaway to power companies or a drag on our nation's economy.

A. Repealing the Capital Gains Tax for Allowances

Repealing the capital gains tax would undoubtedly solve the problems caused by the capital gains tax. Although it is unrealistic to talk about a complete repeal of the tax, a targeted repeal would suffice to fix the problem. Congress could pass a law mandating some artificially high cost basis for emission allocations, or simply exempt them from the capital gains

[107] Imagine Albert owned two plants: one can abate one ton of emissions for $2 and two tons for $5; the other can abate one ton of emissions for $3 and two tons for $7. From an abatement perspective, we can treat this situation as if Albert owned one plant that can abate one ton of emissions for $2, two tons for $5, three tons for $8, and four tons for $12.

[108] Editors: Again, this data comes from http://www.emissionstrading.com

[109] The amount of allowances distributed throughout Phase II, per the EPA Compliance Report of 2002.

[110] Judging from the failure to pass a national tax on electricity to pay for emissions reductions, which would have entailed a similar hit to the power industry. C.f. Paul L. Joskow and Richard Schmalensee, *The Political Economy of Market Based Environmental Policy*, 41 J.L. & Econ. 37, 69.

tax altogether.

The problem with this proposal is that it would result in a huge windfall for the power industry. Even setting aside any distributional issues that this would raise, it would result in considerable political difficulties in passing this measure (environmental groups are uneasy enough with the existence of a "right to pollute" even when it isn't coupled with a blatant tax giveaway). In addition, there is no easy way to offset this windfall and make a proposal involving repealing the capital gains tax be revenue neutral.

It is possible that environmental groups would accept the repeal of the tax if it were coupled with a more stringent future cap, or with some other environment-friendly proposal. This author must confess his total ignorance as to what sort of deal is either possible or likely to fall out of this sort of political horse-trading. Accordingly, the rest of this section will look for a way to neutralize the windfall to the power companies without affecting any other programs or policies.

There is no doubt that the government can recapture wealth from the power industry. This could be accomplished either by charging a fee for the redemption of allowances or by instituting a tax targeted at participants in the emissions market. The difficulty is in figuring out how much wealth the government should recapture in order to balance out the effects of repealing the capital gains tax- and how it can collect this wealth without introducing new market distorting incentives.

The first issue is whether the tax should be set to collect an amount equal to a percentage of firms' actual capital gains, or equal to the capital gains tax that would have been collected but for the tax exemption provided for emission allowances.[111] The power industry would argue that the windfall only consists of the actual money that the government would have otherwise collected. Opponents could argue in response that every trade in which somebody records a capital gain and does not get taxed represents its own windfall. This would be a highly contentious argument, and practical difficulties would remain even after the argument was settled.[112]

Since collecting tax revenues through a counterfactual world construct is probably not workable, the government would have to attempt to recapture a fixed percentage of firms' realized capital gains from allowances. In order to recover the money without reintroducing the bad incentives created by the capital gains tax, any new tax must be levied against power generating firms in general. This would mean that firms that

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[111] The two will quickly diverge because of the increased incentive to realize capital gains created by removing the tax.

[112] In particular, if one were to try to recover the capital gains that would have been collected but for the tax repeal, one would have to somehow design a counterfactual world- and then try to collect a tax based on it, which would be unusual.

are allocated allowances for free from the government would have the ability to impose costs on other firms by realizing capital gains. This is not a desirable side effect.

Repealing the capital gains tax would certainly fix the efficiency problems created by the capital gains tax. However, the proposal would be politically difficult to enact- and any technical change made to alleviate that political difficulty creates more problems than it would solve.

B. Charging a Universal Retirement Fee

The problem we face is that the capital gains tax makes the option of selling allowances less attractive than it should be compared to using the allowances. As discussed above, it is impractical to address this problem by making the option of selling allowances more attractive by repealing the capital gains tax. We are left with the option of making it less attractive to retire allowances.

One way to do this would be to charge a fee to all companies for retiring emission allowances. This approach has the advantage of treating all market participants and all emission allowances the same way. It would also turn the Title IV system into a sort of hybrid between cap and trade and a straight emissions tax, which could be interesting. Unfortunately, it does not address the incentive mismatch problem.

Consider Albert, our power plant owner. His plant will emit one thousand tons of sulfur dioxide if he spends no money on pollution abatement. He can abate one ton of emissions by spending $1; he can abate another ton of emissions by spending $2 more, and in general abating the *Nth* ton of emissions will cost him *N* dollars. The price of a one-ton emission allowance is $300, and the fee for retiring each allowance is $45.

Albert has had one thousand allowances allocated to him. For each ton of emissions that he abates, Albert can sell an allowance for $300, receiving $255 after taxes. He also avoids a $45 fee, so he will take any abatement steps that cost less than $300, which would lead him to emit 700 tons of sulfur dioxide.

Contrast that with Bert's behavior. Bert has a power plant that is identical to Albert's, but Bert has not been allocated any allowances by the government. He will have to spend $300 to buy an allowance for each ton of sulfur dioxide that he emits, and an additional $45 fee per ton to retire the allowance. Accordingly, he will abate until it costs him more than $345 to do so. This leaves him emitting 655 tons of pollution, which means he has spent too much on abatement.[113]

[113] Note that the over-expenditure here does not necessarily mean that the environment will be made better off by charging a universal fee for allowance retirement. The likely result of such a fee is for the market price of

As these examples show, charging a universal fee for retiring emission credits does not fix the distortion caused by the capital gains tax. Companies that are allocated emission credits still have an incentive to emit more sulfur dioxide than do companies that have to buy credits.

Since this doesn't solve the incentive distortion problem, we don't need to worry about the distributional effects of the proposal.

C. Charging a Flat Autarchic Fee

In order to fix a problem that affects companies that receive allowance allocations, we should charge a fee that targets companies that use their initial allocation to cover their emissions obligations.

Accordingly, let's consider the rational response for various actors in the market to a $45 fee that is charged for retiring an allowance that was originally allocated to the company retiring it. We will use Albert and Bert from the previous example, and a market price of $300 per allowance.

Albert was originally allocated one thousand allowances, and he will be charged a $45 fee for each allowance retired. For each allowance he sells, he receives $300 less fifteen percent, or $255. He also avoids paying a $45 fee. This means that his income from abatement (ignoring the cost of abatement) is $300- the $255 gain and the avoidance of the $45 loss. Accordingly, he will abate pollution until further abatement would cost him more than $300, leaving him emitting 700 tons.

Bert was not allocated any allowances, so he will have to pay $300 to buy an allowance for each ton of sulfur dioxide that he wants to emit. Accordingly, he will abate until further abatement costs more than $300, so that he will emit 700 tons of sulfur dioxide.

This indicates that a fee targeting autarchic behavior will put firms that have not been allocated credits on an equal footing with firms that have not. This will allow trading until the most efficient emission behavior is taking place.[114] The problem with this proposal arises from the fact that the price of allowances is not constant.[115] Consider what would happen if the price were to rise to $400 per ton.

Now Albert will be able to sell an allowance for $400 for each ton he abates. After taxes, he will gain $340 plus $45 for the fee that he avoids paying. Accordingly, he will abate until the cost of abatement exceeds $385 per ton, emitting 615 tons of sulfur dioxide.

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allowances to fall by the amount of the fee and for emitter behavior to remain the same. The lower market price might make it easier for environmental groups to purchase and retire allowances, but their effect on the market is generally minimal.

[114] This is an example of Coase's Theorem at work. *See generally* Coase, *supra* note 75. Of course, the other imperfections in the market discussed above would still exist. This is only a solution for the problem created by the capital gains tax.

[115] The price has in fact been quite volatile. See the EPA Compliance report for 2002, page 6.

Bert, since he has to buy an allowance for every ton that he emits, will abate until the cost exceeds $400. This would leave him emitting 600 tons. The mismatch between firms that receives allowances and firms that do not has reappeared. [116]

Again, this proposal fails to completely address the incentive distortion problem. Accordingly, its distributional effects are irrelevant.

D. Charging a Proportional Autarchic Fee

We can solve this problem by tying the amount of the fee to the market price of an allowance. Suppose we charge firms 15% of the market value of the autarchic allowances that they redeem. We will again use Albert and Bert to illustrate the resulting behavior.

Albert's response will now vary precisely with the market price for allowances. No matter what the market price is, the amount that Albert receives for selling an allowance will be equal to eighty-five percent of the market price (due to the capital gains tax). He will also save an amount equal to fifteen percent of the market price by avoiding the fee. This means that his gain from abatement (ignoring the costs of abating) will be equal to (.85 times the market price) plus (.15 times the market price)- that is, his gain will exactly equal the market price for an allowance. This means that he will abate pollution until the marginal cost of abatement is equal to the market price.

Bert, who is not allocated any allowances, is not affected by the fee. The only incentive he faces is the market price, which means that he will also abate until the marginal cost of further abatement is equal to the market price for an allowance.

Charging a percentage fee for autarchic redemption will equalize the emission incentives facing firms that are allocated free allowances and firms that are not. Since they would be trading on an equal footing, allowances would wind up with the firms that valued them the highest.[117] This in turn would mean that we as a society are getting the maximum value possible for each ton of sulfur dioxide emitted. The incentive distortion problem has disappeared.

However, as industry lobbyists would be quick to point out, a new problem has taken its place. Specifically, the power industry will be experiencing a direct loss of wealth to the tune of $360,000,000.00 a

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[116] There is an exception, since firms can always avoid the fee by selling their allowances and buying identical allowances from other firms. This means that if the fee were set at an absurdly high amount we would see efficient behavior, as everybody would exchange their allowances, taking the capital gains hit instead of paying the autarchy fee. At that point the fee is not really a fee so much as it is a mandate to sell.

[117] Again, this is an application of Coase's Theorem. See *infra* note 112.

year.[118] The power industry's loss would be the EPA's gain- and since revenues on that scale would represent about 4% of the agency's budget,[119] we would probably want to pre-allocate the funds somewhere even if we weren't concerned with canceling out the distributional effects of the proposal.

Fortunately, it is relatively simple to neutralize the loss suffered by the industry because of the autarchy fee. The EPA can simply distribute the fee income out to participants in the market based on their relative level of power production. This would not introduce any new incentives (except for increasing incentives to produce power while reducing emissions, which seems ok).

This solution is not free of political drawbacks, of course. It would represent a redistribution of wealth from firms that are allocated allowances by the government to firms that were not. This is not unfair in any subjective sense in light of the fact that the original allocation of allowances represented a wealth transfer from firms that were not allocated allowance to firms that were. To the extent that firms receiving allowances oppose this proposal, the combined efforts of firms not receiving allowances (who are distributional winners) and environmental groups (who want to improve the efficiency of the sulfur dioxide market in order to be able to impose more stringent caps) should be effective counterweights.

E. Consequences of a Proportionate Autarchy Fee System

1. Comparative Dynamics

Thus far we have been comparing the reaction to various fees as if the price of allowances were unaffected by the fee. Of course, this is not accurate. By introducing the autarchy fee we will make allowances less valuable to the firms to which they are initially allocated. This will result in a reduction in the price of an emission allowance. However, the price should not fall enough to make the new price less than the old price minus the autarchy fee.

In the end, emitting sulfur dioxide will be more attractive to firms that have not been allocated allowances by the government, and less attractive to those firms that have. These comparisons are made assuming that everything else in the market remains constant. The total level of emissions should remain constant, but the source of emissions should shift somewhat from firms that were allocated allowances to firms that were not. This state

[118] Assuming a 15% fee, the current market price of $600, and that autarchic retirement is reduced to 4 million tons from the current level of 6.3 million tons.

[119] 3.9% of the 2003 budget of 7.7 billion (EPA Budget *available at* http://www.epa.gov/ocfo/budget/2003/2003bib.pdf).

of affairs would represent a decrease in the amount spent on emission abatement with no corresponding increase in the amount of emissions abated.

The change in market equilibrium may be easier to understand if numbers are attached to the variables described above. Before providing these numbers in the following scenario, I would like to emphasize that they are completely made up, and should not be used by anyone as the basis for any kind of real money investment or prediction.

Suppose that the market price for allowances is $300, and the capital gains tax is 15%. Firms that are allocated allowance will abate until the marginal cost of abatement is $255, while firms that are not allocated allowances will abate until the marginal cost of abatement is $300. Now we enact a law that charges a fee equal to 15% of the market price when an allowance is retired by the firm to which it was originally assigned.

This will result in a drop in the market price- let's say to $280 (the actual drop will depend on the proportion of the allowances previously being used in an autarchic manner). Now firms that were not allocated allowances will only abate until the cost of abatement is $280- they will emit more sulfur dioxide. However, firms that were allocated allowances will also abate until the cost of abatement is $280- they will emit less sulfur dioxide. Since nothing has changed in the factors underlying supply and demand, the total amount of sulfur dioxide emitted should be approximately the same. The difference is that society is spending less money to achieve the same level of abatement- and that reducing the cap further, whether through market action or through allowance devaluation, will be easier than it was before the fee was enacted.

2. Market Response to High Fees

The highest bracket of the capital gains tax[120] will set an upper limit on the autarchy fee. If the fee rate is set above the capital gains rate, firms will simply sell their allocation of allowances (taking the tax hit) and buy an equivalent number of allowances from another firm. This does limit the amount of money that can be collected from this program. However, the point of the fee is not to collect money but rather to fix the market distortion created by the capital gains tax- and if firms are voluntarily incurring the capital gains tax hit, then the market distortion caused by the capital gains tax is clearly gone.

3. Inefficiencies Created by Treating Allowances Differently

[120] Currently 15%.

This program will create a deadweight loss of transactional efficiency because emission allowances can no longer be treated as interchangeable. Any time a firm buys allowances on the market, they would have to make sure that they aren't buying allowances that had originally been allocated to them. This will make it more difficult to conduct transactions, and will probably result in a slight increase in broker fees.

4. Improving Environmental Standards

The result of this proposal would be to reduce the costs to the power industry of complying with sulfur dioxide emissions regulations. However, there is also an environmental payoff from enacting this rule. From the environmentalists' point of view, increased efficiency means that a more stringent cap can be imposed on power companies that inflicts the same amount of total costs. To the extent that regulation decisions are driven by the costs of implementation, a more efficient market will lead to more stringent regulation.

CONCLUSION

The sulfur dioxide emissions allowances market responds to supply and demand just like any other market. Power companies respond to the price signals by abating pollution.

Some firms do not respond appropriately to these price signals. Some of this happens because of the conservative nature of power firms' management, and is not susceptible to a national solution. However, a very easily identifiable portion of this market distortion comes from the effects of the capital gains tax.

Because allocated allowances are treated as having a zero cost basis, firms that receive allowances from the government are reluctant to sell. This reluctance could be overcome either by making it more attractive to sell the allowances or by making it less attractive to use them. As this Article has shown, assessing a percentage-based fee for retirement of an allowance by the company which originally received the allowance will cancel out the disincentive provided by the capital gains tax, allowing the market to work more efficiently.

The efficient operation of the emissions market is in everybody's best interest. The operation of the market directly drives power companies' decisions about how much sulfur dioxide to emit. When the market is operating efficiently, we know that we as a society are wringing the maximum possible benefit out of each ton of sulfur dioxide that is released into the atmosphere.

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