Written Testimony of Dallas Burtraw

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Climate Change: Lessons Learned from Existing Cap and Trade Programs

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Summary of Testimony

Lessons from existing cap-and-trade programs, looking across experiences in the United States and the European Union. The lessons we can learn from existing cap-and-trade programs depend on remembering what it is we are trying to accomplish. The point of emission allowance trading *is not* to trade allowances. Rather, it *is* to achieve emission reductions at less cost than might be occur with other types of regulatory approaches.

As one looks across the performance of the previous programs and across the scholarly literature that has studied those programs, **two observations rise above the rest**. One is the proposition that **the best market design is a simple and transparent**. This is the best guarantee that a cap-and-trade market is fair and efficient and that we avoid learning undesirable lessons from the school of unintended consequences.

The second observation is **the importance of allocation**. Allocation matters to the political success of program, its efficiency, and its distributional outcome. A complex allocation system can cloak unfair and dramatic transfers of wealth. A transparent allocation system will build public confidence in the institution. There are many reasons why an auction should play the dominant role in the allocation, with a growing role over time.

In addition I touch on the following issues:

1. Cost Savings
2. Monitoring and Reporting
3. Time Horizon
4. Banking
5. Allocation
6. Adjustments to Allocation Rules
7. Cost Management

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Climate Change: Lessons Learned from Existing Cap and Trade Programs

Mr. Chairman, thank you for the opportunity to testify before the House Committee on Energy and Commerce. My name is **Dallas Burtraw,** and I am a senior fellow at Resources for the Future (RFF), a 54-year-old research institution, headquartered here in Washington, DC, that focuses on energy, environmental, and natural resource issues. RFF is both independent and nonpartisan and shares the results of its economic and policy analyses with members of environmental and business advocates, academics, members of the press, and interested citizens. RFF neither lobbies nor takes positions on specific legislative or regulatory proposals. I emphasize that the views I present today are my own.

During my 17 years at RFF, I have studied the performance of emission cap-and-trade programs from both scholarly and practical perspectives. I have focused especially on the sulfur dioxide (SO_2) emission allowance trading program created by the 1990 Clean Air Act Amendments and the nitrogen oxide (NO_x) trading program in the northeastern United States. I also have studied the European Union Emission Trading Scheme (EU ETS). I have conducted analysis and modeling to support the Northeast states in the design of the Regional Greenhouse Gas Initiative (RGGI). Currently, I am serving on California's Market Advisory Board for implementation of the state's Assembly Bill 32, a centerpiece of the its greenhouse gas initiative.

I have been asked to comment briefly on the lessons from existing cap-and-trade programs, looking across experiences in the United States and the EU. The lessons we can learn depend on remembering what it is we are trying to accomplish with cap-and-trade programs. The point of emission allowance trading is *not* to trade allowances. Rather, it *is* to achieve emission reductions at less cost than might occur with other types of regulatory approaches. When we implement environmental policy efficiently, more money is available for families and for businesses, or even further environmental improvements can be achieved at the same cost as those that would be achieved without a cap-and-trade system.

Historically, we have relied primarily on prescriptive regulation as the workhorse of environmental policy. This type of an approach has been successful in that it has reduced emissions significantly. It makes sense in situations where control options are obvious, and costs are reasonable. As I have heard my companion on this panel, Brian McLean of the U.S. Environmental Protection Agency, say before, prescriptive regulation establishes *what* needs to be done and *how* and *when* each source has to do it. In contrast, cap and trade relies on the government to articulate a specific social goal with respect to environmental quality, but it enables firms to decide how, where, and when to make emission reductions. This approach is especially compelling when the firms in the regulated industry have equipment of different types and vintage, and they face a complicated array of investment options. In this context, a one-size-fits-all approach does not work well. If the government regulator were to try to prescribe the technology choice in such a situation, it would have great difficulty achieving a cost-effective outcome, because it could not account for all the idiosyncratic conditions facing individual facilities and firms. Cost savings provide a primary motivation for turning to emission trading. One can look at the experiences with trading and discern some important lessons about the design of these programs and how well they achieve their intended goals.

I want to touch on the following issues:

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I close with a summary that highlights the two guiding ideas for program design at this point in the legislative debate: simple and transparent market design, and efficient and fair allocation.

Cost Savings

Convincing literature indicates that important savings have been achieved in cap-and-trade programs compared to the cost of prescriptive regulations. In some cases these results hinge on statistical work and sometimes they are simulation models that indicate expected costs savings. I will cite two examples pertaining to the SO_2 trading program.

Carlson et al. (2000) statistically estimate that the potential cost savings attributable to formal emissions trading, compared to the counterfactual of a uniform emissions rate standard, were $250 million (1995 dollars) during Phase I of the program.[1] They estimate the savings are $784 million per year during Phase II, or about 43 percent of total compliance costs under a uniform standard regulating the rate of emissions at a facility. When compared to an alternative counterfactual policy that forces scrubbing to achieve the same level of emissions, cost savings of the program are estimated to be almost $1.6 billion per year.

[1] Carlson, CP, Burtraw, D, Cropper, M, and Palmer, K. 2000. "SO_2 Control by Electric Utilities: What Are the Gains from Trade?" *Journal of Political Economy*, 108, pp. 1292-326.

Ellerman et al. (2000) provide another estimate of cost savings that is based on an extensive survey of the industry, with extrapolation to estimate long-run compliance cost.[2] The authors estimate the cost savings from emission trading, inclusive of savings attributable to banking, to be about 55 percent of total compliance costs under a command-and-control approach. Hence, two major studies of cost savings (Carlson et al. 2000 and Ellerman et al. 2000) are in general agreement on this estimate.

The sources of cost savings under the SO_2 program are numerous. These studies and others point to the important role that the emerging availability of low sulfur coal played in attaining emission reductions at less cost than many anticipated would be the case at the time of passage of the 1990 Clean Air Act Amendments. Some have suggested this explains away the estimated cost savings. However, the important thing to appreciate is that every other title in the 1990 Amendments employed prescriptive policies to achieve their goals. A prescriptive policy would not likely have enabled firms the opportunity to capitalize on the changing dynamics in coal markets. A prescriptive approach would have constrained the flexibility of firms, and it would have significantly raised the cost of the SO_2 program.

Another feature of the SO_2 and NO_x programs is that cost savings have involved some patentable innovations and discoveries, but they have also involved non-patentable process changes that were not anticipated prior to the program.[3] In some cases, this was simply a matter of looking under the lamp post for cost savings; however, prior to the cap-and-trade program the incentive to look under the lamp post was missing. The cap-

[2] Ellerman, AD, et al. 2000. *Markets for Clean Air: The US Acid Rain Program*. New York: Cambridge University Press.

[3] Burtraw, D, 2000. "Innovation under the Tradable Sulfur Dioxide Emission Permits Programme in the U.S. Electricity Sector," *Innovation and the Environment*, Proceedings from OECD Workshop, June 19, 2000. See also: Resources for the Future Discussion Paper 00–38 (September).

and-trade approach puts an incentive in place to continuously find opportunities to reduce emissions.

Monitoring and Reporting

In the area of monitoring and reporting, the SO_2 and NO_x programs in the United States receive outstanding marks. The use of continuous emission monitoring coupled with electronic data reporting help maintain strong confidence that emissions are properly accounted for. In contrast, Phase 1 of the EU ETS performed weakly in this area because many Member States lacked accounting and monitoring systems at the outset of the program. This led to some of the problems that have been cited with respect to the low stringency of the program in Phase 1. At the outset of the program there was little information about emission baselines, so efforts to establish a cap turned out to be too generous.

However, were we to give out trophies for most improved, the EU ETS would probably win. The purpose of Phase 1 was to develop systems that would enable the EU to meet its commitments under the Kyoto Protocol beginning in 2008, which is the start of Phase 2 for the EU ETS. A major accomplishment of the EU ETS is that it developed a coherent market among 27 Member States using 20 official languages and sharing little in the way of common regulatory approaches before the start of the program.

A lesson for the United States for climate policy should be that only sectors of the economy with clear emission data baselines and accurate monitoring should be included in a trading program. If the program were to be implemented upstream, where fuels enter the economy and can be regulated on the basis of their carbon content, it would simplify the administrative problems. If the program were to be implemented at the point where fuel is combusted and emissions enter the atmosphere, a litmus test should be the quality of monitoring and data reporting for each sector that would be included. The U.S. electricity sector strongly satisfies such a test, but other sectors are more uneven. The program might have an "on-ramp" to allow for an expanding coverage of additional sectors as adequate monitoring is established, and it might benefit from including incentives to improve monitoring or from requiring the compilation of emission inventories throughout the economy, which would be a precondition for expanding the program.

Time Horizon

In this area, the SO_2 and NO_x programs in the United States again receive high marks because their programs have an indefinite time horizon. In contrast, the EU ETS is problematic. The trial period in Phase 1 in the EU ends in December 2007. Plans for the second phase are still being finalized, yet that phase will extend only through 2012. The authorizing legislation for the EU ETS requires that the program should continue indefinitely, but the rules governing its implementation have been broken up into periods matching Kyoto compliance periods. Consequently, firms face tremendous uncertainty about the future. This places difficulties on high emitters, which must develop strategies to try to reduce emissions. It also places difficulties on investors in low-emitting technologies, who cannot be certain about the long-run stringency of the policy.

The SO_2 program provides a useful model for how adjustments can be made in the future as new information about benefits and costs becomes available. Although changes in the SO_2 program were unfortunately slow in coming, due to its original design (which I mention again below), when changes finally occurred, they were implemented in a way that strengthened the trading market and reinforced investor confidence. This change occurred through the Clean Air Interstate Rule (CAIR), which tightens the allowable SO_2 emissions in a large portion of the country beginning in 2010. Without addressing the question of what is the right change or ultimately the right emission target, what is important is the way in which CAIR implements this change. The rule preserves the value of banked emission allowances, thereby reinforcing the value of previous investments. In fact, by not starting until 2010, the rule provides an incentive for early investments to achieve early emission reductions that have value beyond 2010. The owners of these banked allowances will have an incentive to see the CAIR rule meaningfully enforced after 2010. Meanwhile, allocations after 2010 are devalued relative to those received before 2010. Overall this approach to revisiting the emission goal and adjusting that goal provides one useful model for how to adjust a program while maintaining incentives over a long time horizon.

Banking

Banking refers to the ability to save unused emission allowances for use in future periods. The ability to bank emission allowances is expected to save money and reinforce the trading program by offering incentives for early reduction and flexibility with respect to the timing of investments, as well as creating a constituency of those who hold emission allowances and become advocates for a coherent program going forward. Banking is especially important for a program for CO_2 control because CO_2 is so long-lived in the atmosphere that it matters little whether emissions occur in one year or the next; what matters are aggregate emissions. Banking can provide significant cost savings to firms while imposing little environmental effect.

Allocation

In previous writing and speaking, I have often been eager to shine a bright light on allocation because it is so important to the performance of the program. My fear was that an approach to allocation would slip into a program design without sufficient vetting as a centerpiece of the legislation, when in fact, I feel allocation *is* a centerpiece of the architecture of a cap-and-trade program.

This is an area where the EU ETS receives barely passing grades. The approach in the EU was to leave the choice about how to initially distribute emission allowances to the discretion of Member States. However, the EU placed a maximum ceiling of 5 percent on the number of allowances that could be distributed by auction. This is surprising because many observers felt there would be a competition to give allowances away for free to compensate domestic industries or to attract new investment, so the ceiling on the portion that can be auctioned was not relevant. Rather a floor establishing a minimum to be auctioned would help overcome the incentive of Member States acting individually to give away allowances. In fact only five Member States chose to auction any allowances.

There are not many viewpoints you can get economists to agree on, but one exception is the role of an auction. The vast majority of public finance economists would recommend an auction as the most efficient way to allocate emission allowances. With this as a point of departure, there are at least three principled reasons why government might chose not to auction all of the allowances. One would be to provide compensation to the affected firms.

An important finding in this regard, however, is that if firms are given a substantial portion of the emission allowances for free, this could lead to dramatic overcompensation of those firms at the expense of workers and consumers who would face an increase in product prices that was much greater than the costs incurred by firms. There is ample evidence that this has occurred in the EU ETS, where various national studies and industry interests in countries including the United Kingdom and Germany found that electricity generators earned extra-normal profits of several billion euros due to the EU ETS.[4] One German study suggested that in Germany in Phase I of the EU ETS, the program was a continuation of energy subsidies by other means.[5] Our work at RFF finds that if allowances were given away for free in the U.S. electricity sector, it would yield tremendous overcompensation. We modeled the implementation of a policy analogous to that proposed by the National Commission on Energy Policy and found that if the goal of a policy was to provide complete compensation to the electricity industry, it would be sufficient to dedicate 6 percent of the allowance value to free allocation. The remainder of allowances would be available to auction. If the goal were to fully compensate the worst-off firm, then compensation would require 10 percent of the

[4] The House of Commons, Fourth Report of Session 2004-05, March 16, 2005, found "Windfall profits for power generators" in the United Kingdome totaling 1.3 to 3.6 billion euros in 2006. In Germany, "'The utilities get a huge amount of windfall profits, and the energy users get windfall costs,'" complains Markus Weber…at steelmaker ThysseKrupp AG," reported Jeffrey Ball, September 11, 2006, *Wall Street Journal*. A March 6, 2007 report by Deutsche Bank Research, *EU Emission Trading: Allocation Battles Intensifying*, finds, "Power generation companies reap hefty windfall profits."

[5] SRU German Advisory Council on the Environment, April 2006. *National Implementation of the EU Emissions Trading Scheme.*

allowance value and would leave substantial extra-normal profits among those firms that benefit from the program. The remaining allowances would be available to auction.[6]

Two other reasons to give emission allowances away for free might be to promote preferred technologies, or to protect industries that are especially vulnerable to competition from firms that operate outside of the regulatory program. Even though these justifications provide cause for free allocation of some degree, these purposes are dangerous because they open the door for innumerable special pleadings. Complicated allocation rules provide a cloak under which massive transfers of wealth are possible in a CO_2 cap-and-trade program. The principle of simplicity and transparency in the market design for CO_2 applies nowhere more strongly than in the rules governing allocation.

The principle of simplicity and transparency is satisfied by an auction, and the revenues from an auction can be used to achieve other goals as well. Our modeling indicates that the group most affected by climate policy will be consumers. An auction provides an important source of revenue that can be used to achieve broad-based compensation through reductions in taxes or other options. An auction also provides revenues that can be used for research and development, and to provide incentives for investment such as an investment tax credit aimed to promote innovative technologies or to modernize industries that are especially vulnerable to the policy. Another candidate for investment is energy efficiency. In a study for the State of Maryland, we found that the

[6] Burtraw, D, and Palmer, K. 2006. "Compensation Rules for Climate Policy in the Electricity Sector Compensation Rules for Climate Policy in the Electricity Sector," presented to the National Bureau for Economic Research summer meeting. This finding assumes that in regions with cost of service regulation regulators guarantee recovery of costs.

dedication of 25 percent of the allowance value to investments in end-use efficiency could offset any price increase from the state joining RGGI.[7]

A lesson from the voluminous literature in economics and public policy would support an important role for an auction and expanding that role over time, aiming for a complete auction. This lesson is articulated well by a recent report from Deutsche Bank Research (cited above) that found:

> "As emissions trading is developed further, attention should be focused on, among other things, the auctioning of allowances….Greater transparency and a simplification of the system would be the consequences, possibly triggering a more rapid changeover to lower carbon fuels."

The Member States of the EU seem to be moving in this direction, with now roughly one-half of the 27 nations proposing a role for an auction in Phase 2. Nonetheless, the maximum size of the auction in the EU remains constrained during this next phase to be no more than 10% of the allocation. In contrast, the states in RGGI, launched by Governor Pataki and joined by nine other states, will require each state to auction a minimum of 25 percent of their allowances. As of now, five states have declared their intended approach to allocation, and all five have indicated they will auction 100 percent.

Adjustments to the Allocation Rules

The second way that allocation matters is the treatment of sources that retire or new sources that enter the program. Should there be adjustments made to allocation rules? Common sense suggests yes, but economic theory says no. Common sense suggests it is

[7] Center for Integrative Environmental Research, University of Maryland. January 2007. *Economic and Energy Impacts from Maryland's Potential Participation in the Regional Greenhouse Gas Initiative.*

crazy to allow a source to continue to receive allowances it does not need if it shuts its doors. Economic theory suggests that the policy that would remove such an allocation in this circumstance creates perverse incentives to keep the doors open and avoid retirement of what are the most inefficient and dirtiest sources. Similarly, allocation to new sources constitutes a subsidy that can easily draw from the school of unintended consequences. Reviews of the rules in the EU suggest that, indeed, the law of unintended consequences is prevailing, and potentially in a big way.[8]

In contrast, the SO_2 program makes no adjustment for retirements and makes no allocation to new sources. Some have argued this is unfair, but it clearly has contributed to the transparency and success of the program. The problem with the SO_2 design, and I believe there is one, is that the free allocation of SO_2 allowances continues indefinitely. At this point, facilities are identified to receive free allocation after the year 2040 based on their economic activity 60 years previous in the 1985–1987 base years. This free allocation should have been phased out over time in favor of an auction. At the time of the 1990 Amendments the entire electricity industry in the United States was under cost of service regulation. That meant that regulators would make sure that companies did not charge customers for something they received for free. Since that time we have seen the emergence of widespread competition in wholesale power markets and in many retail markets. The stage is set for a very inequitable outcome depending on how allocation rules are established in a CO_2 program.

[8] Åhman M, Holmgren K. 2007. "Harmonizing New Entrant Allocation in the Nordic Energy Market," *Energy Policy* (forthcoming); and Åhman M, Burtraw D, Kruger J, and Zetterberg L. 2007. "A Ten-Year Rule to Guide the Allocation of EU Emission Allowances," *Energy Policy* 35: 1718-1730.

Cost Management

Events in fuel markets, technological innovations, discoveries in science and evolution of public opinion impose great uncertainty on the future of climate policy. In turn, this imposes uncertainty on the cost of a policy. In the long run, policy may adjust. In the short run, however, uncertainty may cause unnecessary volatility in prices in allowance markets. This kind of volatility would serve little useful purpose except to benefit those who make their living off such price uncertainty. For others of us, excessive volatility can undermine confidence in the program and erode investor confidence and even public support. The attached Figure 1 shows that price volatility has been a common feature of emission programs in general.

Looking over previous cap-and-trade programs, the most important case, by far, of unanticipated price movements was in the SO_2 program, in which prices fell dramatically below what was anticipated at time of adoption of the program. As a consequence, for well over a decade until implementation of the CAIR rule, Congress and the American people were not getting what they paid for. The delicate political compromise in the 1990 Clean Air Act Amendments balanced benefits and costs, but shortly after passage of the amendments the precipitous fall in costs meant that balance was lost. Even though benefits far exceeded costs, our feet were "stuck in cement" and no adjustment to the emission cap was available. As a consequence, we have estimated that the American people are losing $8 billion a year compared to a program that would have managed costs and adjusted to signals that were coming from the allowance market. [9]

[9] Burtraw, D, Kahn, D, and Palmer, K. November 30, 2006."Dynamic Adjustment to Incentive-Based Policy to Improve Efficiency and Performance," unpublished working paper.

In the case of CO_2, the natural way cost management could occur would be through the use of a reservation price in that portion of the allocation that is distributed through an auction. A reservation price is a common feature of good auction design; it is even a common feature on eBay. If the willingness to pay of bidders in an auction falls below the reservation price, that item is not put onto the market. Such a mechanism as part of a CO_2 trading program would ensure that precipitous declines in price would not erode the value of investments and the efforts of innovators to push forward with emission-friendly technologies.

The volatility in the EU ETS shown in Figure 1 is interesting because it points out a number of imperfections in the program design. One is simply that the first phase was a test period, which ends in December 2007. There is no bridge between Phase 1 and Phase 2. Consequently all allowances held in December 2007 will have zero value. Moreover, because of the weak institutions for monitoring and reporting emission data at the outset of the trial period, allocations were generous. These problems appear to be corrected for the beginning of the second phase in 2008.

On the other hand, a leading concern of many business groups is that allowance prices could rise to levels that are unanticipated. The nearly six-fold change in natural gas prices over the last eight years shows how volatile energy markets can be, and potential amplification of that volatility through interactions with the allowance market could cause unnecessary economic harm and erode political support for climate policy. A symmetric mechanism to a reservation price on the low side for allowances would be a high-side price ceiling. If that ceiling price is triggered, some additional allowances could be introduced into the market. One source of those allowances might be allowances that previously have been withheld due to the reservation price. Another source might be to borrow from the allocation for a future year. If the high price persists, leading to continued borrowing from a future year, this might trigger an administrative review of the program and recalibration of emission goals and cost limits.

Summary

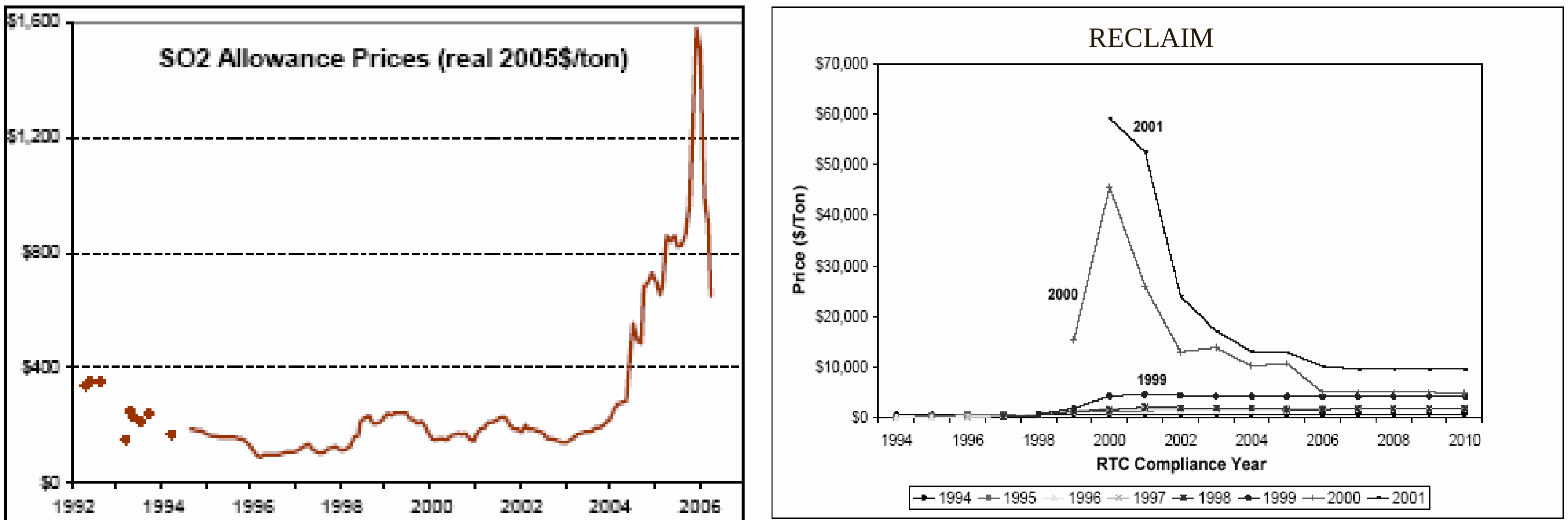
As one looks across the performance of the previous programs and across the scholarly literature that has studied those programs, **two observations rise above the rest**. One is the proposition that the best market design is a simple and transparent. This is the best guarantee that a cap-and-trade market is fair and efficient. If, as they say, the devil is in the details, then the more details there are, the more places there are for the devil to hide. In many cases, details that seem compelling to appease one group or to fix to one problem only beget other problems, opening the door for unintended consequences.

The SO_2 trading program is interesting because in many ways it is an ideal program, beginning with the establishment of a well-defined emission cap that represents social goals. Emission monitoring is accurate and complete, data is transparent, and enforcement is certain. Government's role is minimal, but effective to establish the confidence of investors that rules will be credibly enforced. The remarkable success of the SO_2 program, all observers seem to agree, is its simplicity and transparency. Criticisms of the EU ETS have one common theme, which is that its weakness stems from unfortunate complexity. The organization of the EU ETS is a remarkable political accomplishment involving 27 Member States. To achieve that accomplishment required compromises. The United States should be able to adhere more closely to the SO_2 model. This approach established clear rules, with a strong role for monitoring and enforcement by the government, and then the government stepped out of the way and let the market perform.

The second observation that rises above the others is the importance of allocation. The allocation matters to political success of program, to its efficiency and its distributional outcome. A complex allocation system is one that can cloak unfair and dramatic transfers of wealth. A transparent allocation system will do more to build public confidence in the institution. There are many reasons why an auction should play the dominant role in the allocation, with a growing role over time

I respectfully submit this testimony as one of the strongest advocates for cap and trade. But, I insert a word of caution. There comes a point where political compromise is the undoing of successful market design. We can do a lot in this country with good, old prescriptive regulation. If we get to the point where a CO_2 cap-and-trade policy begins to resemble the Chicago phone book, it is probably better to move away from this kind of approach. However, done right, with an emphasis on simplicity and transparency, the lessons from previous programs indicate that a cap-and-trade program can help us achieve our environmental goals at dramatically less cost than other types of regulatory approaches.

Figure 1. Volatility in Emission Markets



Source: South Coast Air Quality Management District (2002a).