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EMISSIONS TRADING AND COMPLIANCE: REGULATORY INCENTIVES AND BARRIERS*

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TABLE OF CONTENTS

FIGURES

TABLES

APPENDICES

EMISSIONS TRADING AND COMPLIANCE: REGULATORY INCENTIVES AND BARRIERS

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1 INTRODUCTION

Title IV of the Clean Air Act Amendments of 1990 (P.L. 101-549) authorizes the use of transferable emission allowances to achieve reductions in the power generating industry's SO_2 emissions at a minimum possible cost. All electricity generators (greater than 25 MW) are required to hold emissions allowances equal to the amount (tons) of SO_2 emitted during a given year, and meet NO_x reduction levels indicated by the Revised New Source Performance Standards (NSPS).

The use of transferable emission allowances offers utilities greater flexibility in the choice of how to control emissions: the choices include fuel switching, scrubbing, environmental dispatch, repowering, and even the choice not to control emissions (as long as the NSPS and Prevention of Significant Deterioration (PSD) requirements are met). The added flexibility allows utilities to choose the least cost manner of compliance with Title IV requirements. It is hoped (intended) that pollution control cost-minimization by individual utilities will in turn reduce the cost of controlling SO_2 for the electric utility industry in aggregate.[1] In addition, through the use of NO_x emission averaging, the utility would average NO_x emissions from different point sources in order to comply with the prescribed emission standard.[2]

While greater cost savings and flexibility is offered to the complying utilities and other electricity generators, additional challenges also arise for utilities, state public utility commissions (PUCs),

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[1] See T.H. Tietenberg (1980) for a complete treatment of transferable allowances and the theoretical properties of allowances. See ICF (1991) for an estimate of the cost of electric utility compliance with Title IV, assuming nationwide cost minimization through interstate emissions trading.

[2] The issue of NO_x averaging has been one of the more hotly debated topics throughout the Acid Rain Advisatory Committee (ARAC) meetings of 1990-1991. Views differ widely whether low NO_x burner (LNB) technology must be imposed on certain units, and if the averaging is limited to a multistack plant, an air quality control region, a utility system, or an extra-utility system. See *White House Council on Competitiveness to Examine EPAs CAA NO_x Rule*, Inside EPA (January 3, 1992), for more information on current NO_x rule debate.

and the Federal Energy Regulatory Commission (FERC). Issues involving control technology choice, fuel switching, allowance strategies, allowance accounting, tax effects, regulatory review, and least cost planning will all play an important role in the development of the SO_2 allowance market and the players' ability to capitalize on potential compliance cost savings.

The most important factor for the success of the SO_2 allowance market may lie with the PUCs ability to integrate an incentive-based environmental policy into the traditional ratebase, rate-of-return, profit control approach to regulation (McDermott and South, 1991a). The PUCs ability and desire to balance its traditional concerns of efficiency, equity, the state economy, the use of state resources, environmental quality, and reliability may come in conflict with the "flexibility" required to develop a well-functioning SO_2 allowance market that allows firms to minimize compliance costs (South, Bailey and McDermott, 1991). As is documented in this paper, state regulatory barriers and mandates already exist, or will be enacted, which restrict the use, or require the development, of certain technological control options. Depending on the control option selected, utilities may not be able to exercise their least cost option (i.e., interstate trading) due to restrictions by state PUCs to confine allowance trading to the intrastate level.

This paper will examine the multifaceted goals and problems of states and utilities relative to compliance with Title IV, and in particular as they pertain to the development and functioning of the allowance market together with utility pollution control and power generation technology choice. Section 2 presents possible utility compliance strategies along with possible barriers that utilities may confront regarding the development of a SO_2 allowance market. Section 3 discusses current regulatory barriers and requirements being implemented by state PUCs, and Section 4 offers some policy recommendations to achieve the goals of Title IV. Finally, Section 5 presents a summary and conclusion; Appendix A provides programs/mandates developed to date by high sulfur coal states in response to Title IV compliance requirements.

2 UTILITY COMPLIANCE BEHAVIOR AND EMISSIONS TRADING

The initial goal sought by Title IV was a reduction in acid deposition. As written, Title IV attempts to reduce emissions of SO_2 (and NO_x) at the minimum cost of compliance on a nationwide basis. Before Title IV, traditional pollution regulations relied on a command and control approach (i.e., a prescribed emission rate [lbs of pollutant/MMBtu] per generating unit that implied a technology choice) to achieve the desired reduction in emissions. Command and control has been perceived as overly expensive and in some cases failing to achieve mandated levels of air quality. From the properties of SO_2 allowances and control option flexibility for utilities we expect compliance costs less than a comparable level of command and control pollution regulation (Baumol and Oates, 1990). In particular, by using transferable SO_2 emission allowances utilities are able to take advantage of interfirm and intrafirm SO_2 control cost differences, resulting in lower overall compliance costs on a nationwide basis.

2.1 Compliance Through Portfolio Management

The means by which a utility will make least-cost compliance decisions in response to Title IV requirements (i.e., portfolio approach), and how transferable emission allowances will function, requires some explanation. For simplicity this discussion will limit the compliance strategy choices to input and control modifications rather than changes in process (if not technological or fuel changes), reduced utilization or changing affected units in Phase I.[3] To characterize the problem, each utility generating unit has the choice of three possible compliance strategies; over-control, exact-control, and under-control. Defining the type of control and the level of control is based on the unit's initial allowance allocation. For example, over-control implies that the generating unit reduces SO_2 emissions below its Phase I allowance allocation.

Based on the control strategy chosen, the appropriate allowance option is defined. It should be noted that perceived allowance prices will influence the choice of control strategy. In addition, the financial instrument characteristics of allowances should not be ignored; they will play an important role in allowance holding decisions apart from the control strategy chosen. Even though allowances are an input to production and a financial instrument, they are inherently related.

The influences on utility control and allowance strategy are depicted in Figure 1. A wide variety of costs including fuel, capital, and allowance costs will influence the utility compliance strategy along with the need to (1) maintain reliability, (2) comply with state mandated requirements, and (3) accept PUC ratebase treatment (and possibly definition) of the utility's compliance options (and plan). The utility will attempt to balance all these factors to minimize system-wide compliance costs.

The possible control and allowance trading strategies are outlined in Table 1. Over-control in the short term (or Phase I) will likely rely primarily on highly efficient ($90\%^+$) emission reduction scrubbers.[4] This strategy will not require fuel switching to low sulfur coal (although there may be some reverse switching to higher sulfur coal to take advantage of scrubber efficiency), and will free allowances for other uses such as sales, banking, and offsets. Exact-control in the short term implies fuel switching to low sulfur coal, less efficient SO_2 control (e.g., sorbent injection), or a combination of both these options. With exact-control, trading will play a relatively small role as the quantity of SO_2 emitted will equal the allowances initially allocated. Under-control in the short term implies little or no controls and minimal emissions reductions at the generating unit. A utility will be forced to purchase allowances or offset other SO_2 emissions sources in order to achieve compliance for the generating unit (or power plant) relying on this option.

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[3] While these are important strategies for compliance, the use of these strategies may be relatively small in terms of units and capacity (MW) affected as compared to fuel switching, repowering, or scrubbing. In addition, near-term conservation may do relatively little to reduce SO_2 emissions from existing power plants (Bernard and South, 1990). Changing the affected unit by reduced utilization will present that unit with a menu of control strategies similar to other units as modelled above.

[4] The trade literature shows that many utilities are considering the use of scrubbers. This literature includes Electric Utility Week, Electric Power Alert, Utility Environmental Reporter, and Compliance Strategies Review.

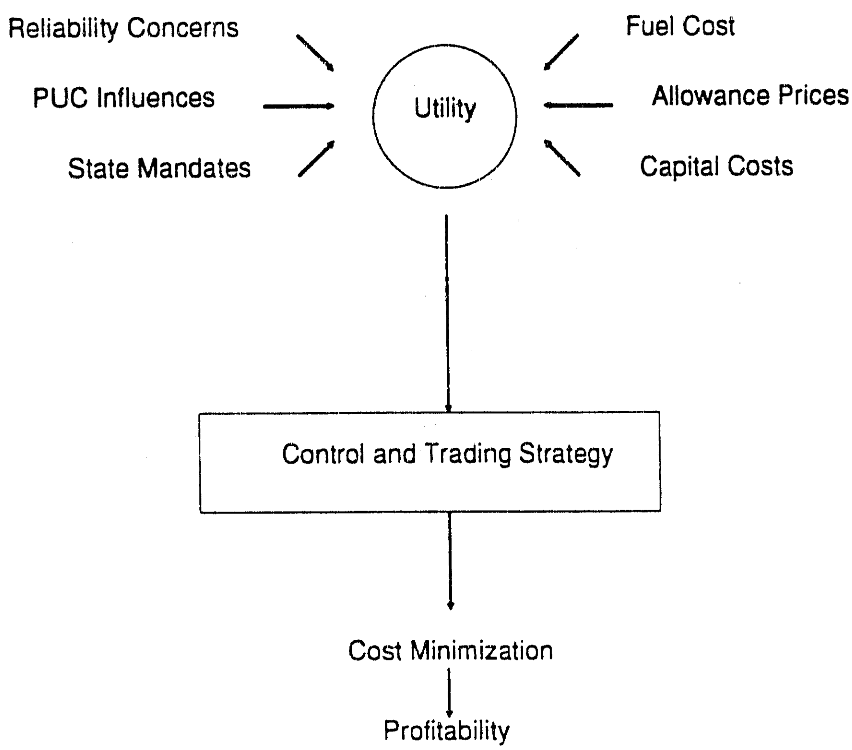

Figure 1 Influences on CAAA Title IV Compliance

In terms of using a portfolio approach to achieve least cost compliance with Title IV the utility has even greater flexibility and potential cost savings.[5] Units with exceptionally high control costs (for which under-control is chosen) can turn to allowance offsets generated by (or allocated to) other units on the utility system, and thus avoid having to purchase them on the allowance market. The use of a portfolio approach to compliance can also offer greater reliability; each control option can be weighted by its respective reliability risk and cost to maximize reliability and minimize compliance costs jointly. By allowing firms to make their own choices of control and trading options, state regulators are able to use firm-specific information to reduce both SO_2 emissions and the costs of compliance.

[5] The use of environmental dispatch and system-wide pooling of emission allowances has also been considered. Environmental dispatch in this interpretation considers the utility's cost of electricity production along with the cost of control from the various utility or power pool units (Heslin and Hobbs, 1989). Those units with the lowest marginal combined costs will be dispatched first, with higher costs units being subsequent by activated/utilized depending on demand. By this method, the maximum number of allowances will be freed for other uses. The state of New York is considering statewide pooling of allowances. For additional details on the mechanics of allowance pooling see Hovey (1991).

Table 1 Utility Choices of Control Plans and the Resulting Trading Strategy

	Over Control	Exact Control	Under Control
Phase I/ Short Run	Highly Efficient Scrubber No fuel switch	Less Efficient Scrubber Fuel Switch to low Sulfur Coal Combination of the two	Few if any controls
Phase II/ Long Run and beyond	Repower with CCT Build a CCT Highly Efficient Scrubber no fuel switching needed	Continue w/Phase I, but with greater stringency since fewer allowances available	Few if any controls
Trading Strategy	Bank allowances for additional growth Use allowances to offset other emissions Sell/Lease Allowances	Hold Allowances to match current emissions During Phase II, few allowances will be granted and new controls or offsets on emissions must be obtained	Purchase allowances

2.2 Risk and Uncertainty Reduction Through Allowance Trading

While utilities stand to gain millions of dollars in compliance cost savings through interstate/interfirm allowance trading, the utilities may be their own worst enemies when it comes to allowance trading. For reasons of (1) supply uncertainty, (2) speculation, (3) load demand and technology performance uncertainty, and (4) creating competitive barriers, utilities may choose to horde/hedge allowances that could potentially be traded to generate firm profits. If too pervasive, this hedging/hording could result in a thin and price volatile allowance market.

Allowance trades in the short run may be few given uncertainty regarding the quantity of allowances available for sale in the evolving allowance market. Holding allowances to match present emissions, and to enable capacity expansion, is of grave importance to utilities. Allowances are a necessary input to the production process of the utility. As the firm is required to supply the electricity demanded, it is required to ensure that it has sufficient allowances to match that quantity required for generation. Without enough allowances to cover emissions from the electricity generated, the utility would incur large fines and could in effect, be prohibited from generating electricity if allowances could not be purchased at an appropriate price. The uncertainty about obtaining allowances will influence the choice of control options and allowance holding behavior, and may result in very few trades taking place.

A counter argument is that if utilities decide to hedge and hold allowances so as to reduce the supply available in the market, the resulting price increase should encourage other utilities to engage in allowance trading. While this argument is logical it may ignore some fundamental realities. Allowances held by the utility serve the role of compliance today and compliance tomorrow and allowances, as such can function as a financial instrument. A utility may elect to bank allowances in order to capitalize on potentially higher allowances prices in the future.[6] This speculative hedging of allowances leads to fewer allowances for trading in the near term and results in both short- and long-term allowance price uncertainty.

Utilities also face uncertainty with regard to energy demand over time and emissions control performance. In order to self-insure against increased energy demand, or emission control failure, the utility may over-control to create a compliance "buffer" (South, Bailey and McDermott, 1991). This will occur if the utility believes that allowances will be difficult if not impossible to obtain in the market and finds that over-control and self-insurance is a cheaper option than purchasing from EPA's direct sale market or the proposed Chicago Board of Trade (CBOT) market (Inside EPA, 1991).

What may be an even greater source of thin trading is allowances held to compensate for future growth. As a utility's generating units become older, their value declines. To replace the depreciated units the utility has the choice of purchasing external power or building new

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[6] If the value of the banked allowances did not grow over time, the owner of the allowance should sell the allowance in order to use the funds to invest in an financial instrument or capital that will increase in value over time, hence maximizing the net present value of the owner's assets.

generating facilities.[7] The utility earns a return on its own capital whereas power purchases are largely passed through, without a return of (or on) capital. A utility holding banked allowances, or allowances associated with a retired unit/plant, is likely to have a cost advantage over an IPP that must purchase allowances in the market or from a utility in order to construct a generating plant. As a side note, holding allowances to compensate for future capacity compliance may be a better option for the utility than selling because some of the value of those allowances will (mostly likely) be required (by PUCs) to be shared with ratepayers.

In a sense, utility reactions to the uncertainty in the allowance market may lead to even greater uncertainty. Hedging/hording behavior might lead to a thinner market; a thinner market implies greater price volatility and supply uncertainty. Greater price and supply uncertainty provides utilities with an incentive to take further measures to self-insure against these uncertainties and potentially engage in even greater levels of hedging/hording. The magnitude of utility reactions to the above four sources of uncertainty will effect the level of potential cost savings. Regulatory and market solutions to reduce this uncertainty and aid market function are presented in Section 4.

3 TITLE IV: STATE AND PUC REGULATORY BARRIERS AND CONCERNS

State PUCs are wary of the potential costs of utility compliance decisions and have the ability to use prudency rulings on control options and trading strategies to influence utility choices.[8] Forcing choices inhibits the flexibility of utility compliance strategies and lowers the potential for cost savings to society.[9] In this section, the impacts of utility control choice, existing and potential regulatory incentives for control technology, and regulatory barriers to certain control technologies are examined.

3.1 Regulatory Barriers to Compliance

Congress has clearly not prohibited any state from imposing restrictions on allowance trading and other responses to Title IV (Clean Air Report, 1991) so in part it allows states to establish programs that may inhibit the effectiveness of Title IV. New York has examined the issue of limiting emission trading both into and out of the state in order to protect areas within New York

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[7] Conservation is also an option to be combined with these two strategies but DSM is unlikely to produce enough "negawatts" to completely and cost-effectively affect the need for additional power (Bernard and South, 1990).

[8] Appendix A indicates programs recently implemented by several high sulfur coal states that offer incentives (or mandates) for the use of in-state coal.

[9] Currently several states have mandated utility compliance choices. Illinois for example has mandated the use of scrubbers on several of Illinois Power's Baldwin units and on Commonwealth Edison's Kincaid plant. Other states such as Ohio and Indiana have influenced compliance choice by requiring the utility to take into account the cost of fuel switching on the local economy, see South and McDermott (1991b) and Clean-Coal/Synfuels Letter (1991).

that have been greatly affected by acid deposition (Clean Air Report, 1991). States such as Ohio, Pennsylvania, and West Virginia face the problem of multi-state utility holding companies that may shift SO_2 allowances to out-of-state plants changing the use of state resources and environmental quality. Restriction of out-of-state allowance trading will limit potential cost savings, tending to force the units in question to choose control options that are not cost minimizing (from a utility perspective).

Typically, PUC (and state) goals relating to the regulation of public utilities consider the equity of rates, the efficiency of operation and construction, the use of state resources by the utility, the impact of utility compliance decisions on the state economy, the relation between environmental quality and utility emissions, and the reliability of electricity supply. Traditionally, the PUC has concerned itself with equity, efficiency, and reliability issues, with concerns about state resource use, impacts on the state economy, and environmental quality being less important. With the advent of least cost planning, increased competition in the market for wholesale electricity and the growth of the externalities issue, PUCs are increasingly grappling with concern over state resource use and environmental quality (Vine et. al., 1991).

The least cost planning (or similar planning/rate making procedures) role of the PUC comes into direct conflict with the compliance flexibility objectives of Title IV. Generally, the PUC attempts to maximize the net benefits of electricity generation within the state, which includes secondary costs such as state resource use, the resulting local job creation, and statewide (and to a certain extent regional) environmental quality. The flexibility of allowing utilities to choose their own compliance strategies, fuel choice, technology use, and SO_2 reduction may be in conflict with a particular state's objectives; for example, the utility's least cost compliance strategy may not be least cost to the state when factors such as the local economy, environmental quality, and cost allocation are considered.

Those states possessing large high sulfur coal reserves, and whose utilities are largely fired by high sulfur coal, have the most to lose from implementing Title IV; these states include Illinois, Indiana, Ohio, Kentucky, West Virginia, and Pennsylvania. Most southern and midwest states use large amounts of high sulfur coal for electricity generation. Losses to the high sulfur coal states arise not only from increased compliance costs, but also from the potential mining employment and local economic losses incurred by utilities switching to lower sulfur western coal or eastern compliance coals from traditional high sulfur coal states. In addition, the states of Virginia, West Virginia, Pennsylvania, and New York are concerned with the acidic precipitation that falls within their borders and the ability of the Title IV to address this problem.

The presence of multi-state utility holding companies also presents a problem to states grappling with SO_2 over-compliance proposals. Claims on the holding company's allowances by states in its operating territory presents important legal and compliance problems. Optimally, the utility system should be able to transfer allowances among its member utilities (and generating units) without regard to state lines. The states, however, have an important equity argument about its citizens having "paid" for the generation of those allowances in prior year rates. To address all these problems, states have introduced or passed legislation to maximize state welfare; in some cases the legislation authorizes the use of incentive regulation (see Appendix A).

3.2 Impact on Trading of Compliance Options

The greatest potential conflict between state goals and those defined in Title IV is over choice of SO_2 control technology. Current debate has centered on two control options: scrubbing flue gas emissions or switching from high sulfur midwestern coal to low sulfur western or eastern compliance coal. The relevance of fuel switch decisions is extremely important due to Phase I targeting of the largest polluting coal facilities (which use high sulfur coal), and the impacts on those states that produce high sulfur coal and use high sulfur coal as their primary fuel for electricity generation. Phase II of the program will affect all utility units (except those less than 25 MW) and the range of control options is potentially greater. The magnitude and type of impacts on state goals will determine (and has influenced) state regulatory responses.

3.2.1 Over-Control

Choice of the over-control option by a utility in Phase I will likely result in higher electricity rates due to greater capital costs associated with highly-efficient scrubbers or very clean but capital-intensive generating technologies (e.g., clean coal technologies [CCTs].[10] While these rates may be higher in the near-term due to adoption of CCTs, in the long run rates would likely be lower than without CCTs. In addition, the over-control option may produce significant benefits for high sulfur coal states if scrubber or CCT options are chosen. The additional cost of electricity may be of lesser importance when compared to the maintenance of high sulfur coal markets and the associated employment and economic benefits.

The over-control option will also free allowances for sale and banking. For those states desiring or predicting strong economic growth, holding allowances by in-state utilities provides for additional capacity growth from banked allowances, thereby avoiding future allowance price risks through market purchases. Over-control options may also benefit local environmental quality. While acid precursor emissions are mainly thought of as a regional, multi-state problem, some of the emissions are converted to deposition within state boundaries. In addition, ambient SO_2 and NO_x are believed to cause health, materials and vegetation damages, together with decreased visibility (Ottinger, 1991). Consequently, lower SO_2 emissions may lead to improved local environmental quality.

The over-control option may also provide significant information benefits when the development of CCTs and other innovative, low emission technologies are considered. The initial costs to ratepayers from over-control may be offset by the long run decrease in the social and private cost of electricity (McDermott and South, 1991a).

[10] Conversion or replacement of coal units with natural gas may not result in large rate impacts, but the uncertainty surrounding future natural gas supply may make this choice undesirable for many utilities and regulators.

3.2.2 Exact-Control

The choice of the exact-control option will result in a smaller increase in electricity prices as the control options are not, in general, as expensive as the over-control options. Cost increases for the utility will come from higher fuel costs or the installation of less-efficient flue gas control equipment. High sulfur coal states will likely be hurt by this strategy as utilities within (and outside) the state switch to low sulfur coal, causing increased unemployment among high-sulfur coal miners and negative economic effects on the localities around the mines. The low-sulfur coal industry will, however, experience an increase in employment and the areas around low sulfur coal mines will experience positive economic effects.[11]

The exact-control option and resulting trading/strategy may also limit the potential to draw on banked allowances for utility growth. This may or may not be a problem depending on a variety of factors including the capital costs of various electricity generating options, fuel costs, the development of the SO_2 allowance market, and electricity demand growth. Gains in local environmental quality may be less when compared to the over-control option.

3.2.3 Under-Control

The choice of under-control probably cannot be thought of as an option for the majority of the nation's utility systems. While no additional capital or fuel costs are incurred, the ratepayers of the state are exposed to significant risk from relying on allowances from an uncertain and potentially volatile SO_2 allowance market.

Will these unit-by-unit control options have a significant impact on an entire utility's costs and the resulting impacts on environmental quality, fuel use, the local economy, and rates? At this point in time we can look to a few trends on the subject of compliance and coal market impacts. Fuel switching will be used extensively by utilities as a least cost compliance option in both Phase I and Phase II; Metzroth and Knutson (1991) estimate 76% of Phase I and 52% of Phase II units.[12] If this estimate is accurate, high sulfur coal markets will experience significant decreases in production and mining employment as utilities switch to low sulfur coal, while the lower sulfur coal fields will experience increases in coal demand and employment (ICF, 1991). Furthermore, Metzroth and Knutson (1991) conclude that 27 utility companies, located primarily in the Midwest and Mid-Atlantic states, will bear 71% of the costs of compliance. Consequently, Title IV will have a significant cost impact on the economies of several states and the financial status of only a select number of utilities. It is rational, then, to presume that these states will enact legislation or regulations that minimizes their cost burden.

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[11] This is not saying there will be a 1:1 inverse relationship between high-sulfur coal miner employment and low-sulfur coal miner employment. Low-sulfur coal mining tends to be significantly less labor intensive and relocation costs for the high-sulfur coal miners to the proximity of the low sulfur coal field may be prohibitive.

[12] The results were derived from least cost power pool compliance strategies. The results may change dramatically based on expected SO_2 allowance prices, fuel prices, and regulatory impacts.

3.3 Regulatory Restrictions on Interstate Trading

In addition to technology requirements, the threat of ex post prudency review, and requirements to include the costs of displaced local mining jobs (and the resulting secondary impacts), several states have indicated that allowance trading may be restricted to intrastate trading.[13] Limiting intrastate allowance trading can be ascribed to three factors: (1) internally held (by the state) allowances preserve the state's ability for economic growth; (2) desire of "downwind" states to avoid releasing allowances to "upwind" states;[14] and (3) limit the amount of allowances brought into the state to prevent an increase in in-state acidic deposition.

By restricting allowances to intrastate trading for purposes of economic growth, states are attempting to ensure that increased future demand for electricity can be met by the use of banked allowances or allowances from retired facilities. This would potentially reduce the need to purchase allowances on the market and avoid the risk of higher electricity costs. The general effect of any of these three policies would be to reduce the potential gains from trade and result in greater electricity rates for those within (and potentially outside) the state.

An unfortunate result of emissions trading, and one that several states may attempt to block through the use of limited trades, is the existence of acidic "hotspots". An emissions target for SO_2 was chosen due to ease of monitoring, enforcement, and the ability to achieve a lower overall compliance cost.[15] Trading of ambient SO_2 pollution rights would have been a much more difficult program to implement given emissions-to-ambient pollution measurement difficulties, legal conflicts over the emission-to-ambient transfer coefficients, and the initial allocation of SO_2 allowances for ambient pollution. However, concentrating on SO_2 emissions reduction is not without a significant risk.

To illustrate this risk, the following scenario is defined: newer, lower-cost control facilities install additional pollution control to free allowances for sale (see Figure 2). These units built after 1972 or 1978 make a relatively small contribution to ambient SO_2. Older coal units with much higher pollution control costs purchase the freed allowances instead of implementing much stricter and costlier control measures. Under this scenario, aggregate SO_2 emissions are reduced at minimal compliance costs, but will acid deposition decrease?

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[13] Several states have already restricted trading, see Environment Week (1991).

[14] This would result in increased acidic deposition on the "downwind" state.

[15] From arguments in Baumol and Oates, (1990), Tietenberg (1985), and current methods of monitoring pollution (i.e., emission limits) we can assume that emission targets were used rather than ambient concentrations. If ambient concentration allowances were chosen, we find that a multitude of trading markets would be created that only a few sources could readily trade in. The multiple markets would lead to greater monitoring costs and lower costs savings (not as many firms to trade with).

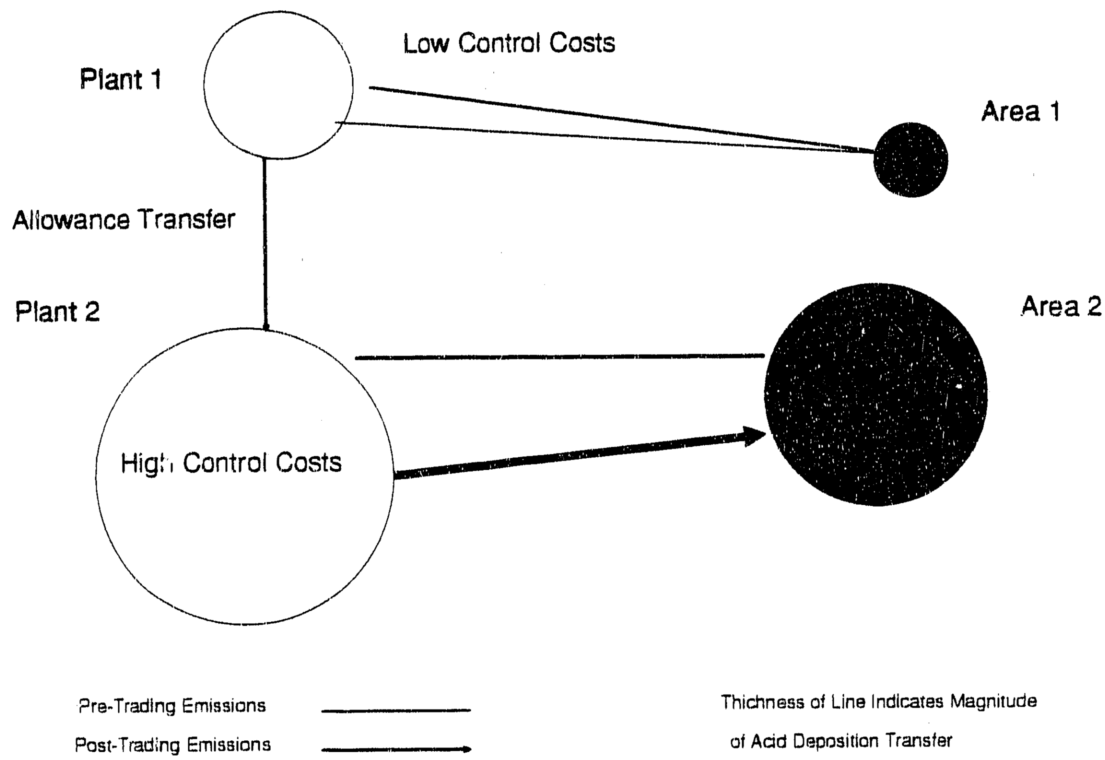

Figure 2 Transfer of SO_2 Emissions Through Allowance Trading

The older, larger contributors of atmospheric SO_2 may maintain their pre-1995 emission rates (or decrease emissions by a small percentage). In this scenario, the areas "downwind" of the plant will still experience the same levels of acidic deposition whereas areas that experience only low levels of acidic deposition may actually experience decreases. If the local increases of acid deposition are affecting sensitive areas, the cost-effectiveness (in terms of marginal damages) of the program may be in question.

Title IV targets SO_2 and NO_x for reductions and seeks to meet at least the SO_2 reduction at the lowest possible social cost. But there may be some foreseen and unforseen consequences that will raise the cost of compliance and fail to achieve a dramatic decrease in acid deposition originally envisioned. The "hotspot" phenomenon has already been indicated as a potential failure of Title IV (South and McDermott, 1991). In addition, the development of the SO_2 allowance market may be stymied by unclear price signals, uncertain allowance availability, and a lack of means to insure against a shortfall of allowances. All these factors would reduce the potential cost savings.

Since the primary target of Title IV is the public utility industry, and this group of firms is highly regulated by states, the PUC and state legislature play an extremely important role in utility compliance strategies and the development and function of the SO_2 allowance market. The utility will minimize overall costs with respect to control options, trading strategies, and regulatory requirements. The utility will take into account state incentives (in effect), and possible bonuses and losses from PUC actions reacting to the utility's compliance plan.[16] Moreover, states may have objectives that conflict with the goals of Title IV. Figure 3 illustrates state concerns and goals as they relate to utility compliance with Title IV.

4 REQUIREMENTS AND POLICIES FOR A WELL-FUNCTIONING ALLOWANCE MARKET[17]

While a well-functioning SO_2 allowance market will enable utilities and other sources to meet compliance goals at costs lower than tradition command and control regulation, a market is not a creature which springs like Pallas Athene from the head of Zeus, but rather a complex institution with many uncertainties, asymmetric information, and behavior that only vaguely resembles the stories told in introductory economics textbooks. A well functioning market for the exchange of goods and services typically takes many years to develop, during which the good's nature determines the institutions, contracts, and customs needed to facilitate transactions with reasonable costs and relatively low levels of uncertainty.

The SO_2 allowance market may develop at a slower rate because of the good's unique nature (trading in pollution rights) and the newness of the good. Slower development will mean greater costs of compliance and greater uncertainty in the near-term as utilities reject flexibility and greater risk in favor of compliance certainty and possibly higher costs. As the SO_2 allowance market will partially fall under the jurisdiction of state PUCs and FERC it can be considered a regulatory policy instrument for the achievement of least cost compliance to the SO_2 regulations. For this incentive instrument to work, we must first decide what makes a market successful and the potential problems arising in market development.

The success of a market can be attributed to the following factors: (1) market liquidity; (2) market stability, and (3) market organization (Burns, 1979). Each is discussed in detail below.

4.1 Market Liquidity

In the case of market liquidity, a major concern has arisen with regard to allowance trading. Because allowances are needed to support the yearly output of electricity, and because all new incremental and replacement plants will receive no additional allocation of allowances, there has been a fear that utilities will hoard allowances. If hoarding occurs, markets will tend to witness

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[16] See K.A. McDermott and D.W. South (1991b). The ability of the PUC to review utility compliance actions will create an important incentive for the utility to comply with plans that the PUC may favor. Moreover, approval of a compliance plan by the regulator is a critical goal for the utility.

[17] This section draws heavily on McDermott and South (1991a).

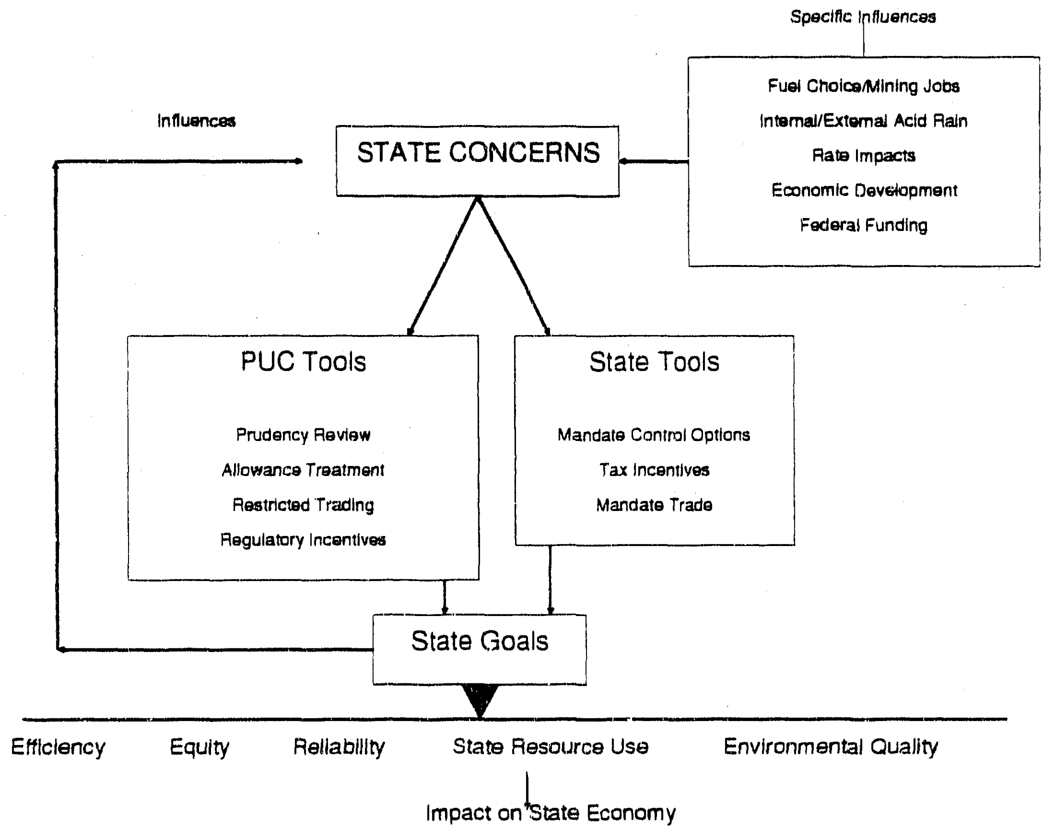

Figure 3 State Goals and Title IV Compliance

"thin" trading or a low level of liquidity. As a result, prices will be volatile, and the risks associated with trading will increase. Likewise, if supply uncertainty prevails, there will be less reliance on markets to supply allowances to meet compliance requirements. The result would be each firm self-insuring its own supply of allowances by over-control and exact-control. Interfirm SO_2 allowances trading would be relatively small so differences between utility compliance costs would not be exploited or compliance savings generated. The end result would be greater compliance costs.

Market liquidity is the product of a number of factors: the strength of demand, transaction costs, standardization or homogeneity of the product, product quality, inventory costs, and default risks. As the number of transactions grow, price and quantity information becomes available that enables a firm to forecast prices and plan transactions. The greater the number of transactions (i.e., the thicker the market), the lower the uncertainty will be concerning price and quantity.

We should expect to see both a spot and a forward market develop for allowance transactions, and given the uncertainties involved, we might expect there to be a mismatch in the time horizons driving sales and purchases between buyers and sellers. In the short run, sellers of allowances might be expected to participate in spot sales of limited numbers of allowances, while buyers, envisioning new capacity (whether utilities or IPPs), will seek long-term contracts. As a result, we might expect a greater level of spot market activity than forward market activity at rather high prices. At this early stage in the market's evolution, it would be incorrect for policymakers to have an adverse reaction that would result in interference with the price. Price, after all, is the stimulus to market innovation.

As a result of a high spot price and a weak forward market, we would expect to see utilities create complex deals to achieve compliance and generate greater flows of excess allowances. For example, utilities could jointly finance scrubbers at a particular unit with one utility receiving a long-term contract for allowances based on financial assistance. As an alternative, joint construction of a new plant could occur to accelerate the retirement of older, less efficient units and free up allowances.

As these actions are undertaken, the flow of allowances will increase; it is even possible that long-term contracts involving the lending of allowances by one utility to another, in exchange for a reciprocal loan at some future time, could be arranged. Alternatively, regulators could induce utilities to become involved in early over-compliance to increase the availability of allowances for long-term trades. However, a note of caution is necessary.[18] Any policy action that increases supply will, all else being equal, result in lower allowance prices, which will thwart the profit incentive to trade, and, in some cases, postpone cost-effective compliance options today because of the artificially cheaper option of purchasing allowances. Markets are both fragile and powerful; the price incentive is a delicate mechanism that will respond to natural trends and collapse under artificial stimulus.[19]

4.2 Market Stability

In terms of market stability, the central issue will be the responsiveness of buyers and sellers to price fluctuations. This responsiveness is, in turn, conditioned by a number of factors such as the ease of entry and exit from the market, the level of information on prices and trading opportunities, and the ease of access to a regularized exchange or marketplace. In many cases, the lag associated with entry and exit could be substantial. It takes time to create excess allowances, and for some utilities facing a shortage of allowances, there may be no possibility to exit from the market. In some cases, the market will be able to respond through the development of option contracts or other instruments that can bridge the uncertainty of supply

[18] For additional examinations of the regulatory issues involving allowance trading and pollution regulation, see Rose and Burns (1991), and McDermott and South (1990).

[19] Remedies exist to combat market failure within the CAAA. The allowance set-aside and auction process is designed to breach the gap if hoarding or thin markets occur. For a detailed discussion of the auction process, see Hausker (1990).

associated with the building of new scrubbers, repowering projects, and other programs to create allowances. Moreover, once the market has had time to respond and the quantity of excess allowances increases, more bridging deals can be consummated through short-term leases (see Raufer and Feldman [1987] for a further discussion of this option).

Market stability can also arise through the actions of specialized agents willing to bear risks. These speculators can have a beneficial effect on markets to the extent that there are enough traders willing to buy low and sell high. In a similar vein, if multiple regional trading markets exist, agents playing the role of arbitragers can enhance the liquidity and stability of markets by transferring allowances between markets where price differentials exist. Over time, as markets grow and transactions increase, one would hope there would be less need for agents to undertake these risks.

4.3 Market Organization

Market organization is critical to the success of trading. A market implies some centralized place of exchange, where information on prices and quantities can be regularly and quickly obtained. In modern markets, such institutions as information clearinghouses, exchanges, and computerized transactions are employed to improve the market's efficiency. It is essential that information be easily accessible and that no barriers to information exist, otherwise, not only will valued exchanges not occur, but in many cases, the highest bidder will not be exchanging with the lowest-cost seller.

Currently, the Chicago Board of Trade (CBOT) (Passel, 1991) is establishing a futures market for the exchange of SO_2 emission allowances. CBOT should be able to provide market organization, market stability, and even liquidity. The use of a centralized and experienced trading institution should be better able to absorb risks that neither the public utilities (and ratepayers/PUCs) are able to bear or effectively allocate. From a private market/incentive aspect, SO_2 allowances eventually will be able to offer the utilities the flexibility and potential to operate in the most cost-effective way to achieve compliance if no market-inhibiting regulatory barriers to trade are created.

In the treatment of emission allowances, conditions exist in which (1) exchange could take place frequently or occasionally, (2) specific investments are made and opportunistic behavior is possible, and (3) information may be limited and uncertainty prevails. In some cases, specialized agents will arise to take advantage of the imperfections in information. In this case, brokers may even behave opportunistically to increase transaction costs and limit the flow of information. Given the potential dichotomy of the market into spot and forward exchanges, regulators should take actions that will promote the flow of information to the parties exchanging allowances and should work to eliminate information bottlenecks and barriers to information flow that could be created by third-party middlemen.

In the case of the spot market, regulators should encourage the formation of allowance pooling and exchange in the same fashion as electric power pooling. These exchanges could function on a weekly basis, in which utilities would electronically submit bids and asking prices for allowances on the basis of the incremental or decremental cost of creating or avoiding allowances. Computer programs would match high and low prices to maximize the surplus from exchange and then share the gains on the basis of the utility's level of participation or some other reasonable rule. Regional pools of this nature would allow arbitrage and speculation to occur, which could function to stabilize the market. Since the transactions occurring are designed to promote efficient exchange, regulators could presume that trades are prudent, reducing one element of risk faced by utilities. In developing an effective spot market, greater information will be available to assist utilities in planning future trading strategies and enhance the market's liquidity.

In promoting forward market exchanges, regulators could stimulate trading by establishing a set of rules governing contract clauses and a few other terms and conditions that will protect the public interest while fostering profitable trade.[20] Since many of these contracts may involve new investments in plant and emission control facilities, the special circumstances of each utility must be considered. Since, in many cases, these contracts will involve long-term projects and require lengthy negotiation, it is more likely that concurrent PUC review is possible. Once the contract is established, it should be presumed prudent.

Alternatively, PUCs could establish bidding processes in which utilities would seek suppliers or joint ventures to build new plants, emission control projects or supply long-term allowances. This process would allow all potential bidders enough time to make reasonable offers and maximize the number of participants, thus stimulating a competitive environment. Once again, the winning bid could be presumed prudent. Whatever action the regulators adopt, it should be designed to maximize the number of participants and information flow and reduce transactions cost. In this way, it may be possible to overcome the imperfections that exist in the characteristics of the emission allowance market and achieve a workable degree of competition and efficiency.

4.4 Regulatory Treatment of Allowances

Regulators have traditionally been forced to balance the issues of equity and efficiency. This tradition has tended to minimize any reliance on the profit motive because of the underlying concern over the utilities' monopoly position. In the case of the electricity end-user market, this philosophy may not be unreasonable. However, in the case of inputs to the electricity production process, the profit motive could result in lower prices to end users. To ensure the protection of the end-user, regulators should adopt a standardized accounting process to treat the costs associated with excess emission allowance production.

As excess emission allowances are generated, those that are used in the production of electricity for sale to end-users or to wholesale customers would have these costs passed through in their respective rates. To the extent that excess allowances are banked for potential use, they should be treated as inventory and granted a return just like other inventories of coal. As they are used, they should be deducted from the inventory and charged to the respective customer. In cases

[20] The experience of regulators with the contractual problems of the natural gas industry in the 1980s will certainly bear on this process.

where allowances are sold from the bank to buyers in the allowance market, the profits from these sales should be shared between stockholders and ratepayers, because the ratepayers have paid for some portion of the cost through the return granted on inventories.

Regulators should refrain from eliminating profits to stockholders or the profit motive that is the driving incentive of this program will be defeated. It is possible that utilities would request that the allowance costs not be placed in the rate base via inventories but rather that they absorb the risk and have the option of charging customers the cost-based rate when used in the production of electricity, and receive the entire profit from allowance market sales. The only problem with this policy would be the need to ensure the minimum requirements to maintain least-cost electricity production. It is possible that utility plans could be submitted that identify future allowance needs, and that these allowances would be placed in inventory with the "excess allowances," free for the utility to sell on the market.[21]

This form of accounting rules would also easily accommodate the purchase of allowances needed for electric generation or speculation by the utility. By setting up a fair set of rules governing allowance treatment, regulators will take a great step toward stimulating an economical set of decisions and an efficient trading market.

Finally, the use of permitting and compliance for Title IV must be addressed.[22] Fortunately, in conjunction with source permitting, compliance flexibility has been preserved by allowing some flexibility with regard to allowance trading. While the requirement of holding SO_2 allowances equal to annual SO_2 emissions must be met in all cases[23], several compliance alternatives are allowed so that the utility may take advantage of allowance market opportunities. While some flexibility is allowed in terms of SO_2 compliance, other pollutants which are "permitted" to a certain level will change. This would result in the violation of Title V permit requirements.[24] While flexibility is preserved for SO_2, other fixed pollutant requirements may restrict the ability of the firm to react to market opportunities and reduce the gains generated by allowance trading.

5 CONCLUSION

Title IV of the Clean Air Act Amendments of 1990 creates a fundamental change in how utilities will control SO_2 emissions. The use of SO_2 allowances will give utilities significant flexibility to determine the least cost method of control and allow utilities to capitalize on interfirm control cost differences. Through this incentive, compliance can be achieved at lower costs than traditional regulation, and SO_2 allowances also create additional incentives for the creation and

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[21] If the return on inventories approximated the market return from sales of allowances, there would be no inherent bias in the utility planning process.

[22] P.L. 101-549, Section 408.

[23] P.L. 101-549, Section 408(a)(1).

[24] P.L. 101-549, Section 504.

adoption of new control technologies and processes as the freed allowances have economic value. In addition, allowances can serve as means of hedging risk and altering cash flows.

The flexibility allowed to achieve the goals of the Act, however, may conflict with state goals. Through legislative mandate and the PUCs, states are able to influence utility choice through a wide variety of traditional and incentive regulations. Most of these regulations alters the costs of adopting control options in order to encourage scrubbing. While this may be the least cost state strategy to meet the requirements of the Act it may not be cost-minimizing in a global sense.

The SO_2 allowance markets should be allowed to develop free of any operating restriction which distort the market value of allowances. In addition, the accounting value of allowances should not distort utility choice in favor of any particular control option. This type of distortion will alter the value of the allowances and result in nonoptimal behavior.

Price distortions of control options should also be avoided to achieve the cost minimizing goal of the Act. This statement however is subject to much criticism from those states that will suffer large economic losses from utilities switching to low sulfur coal. A more proper role for technology incentives may be the promotion of innovative control and energy generating technologies that achieve the goals of both the Act and the states. Technologies which control SO_2, NO_x, or other pollutants with a greater removal rate and at a lower cost, which also result in the use of local resources and lower energy costs, can achieve the goals of both the Act and the affected states.

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APPENDIX A STATE RESPONSE TO TITLE IV OF THE CLEAN AIR ACT OF 1990

In response to the expected cost burden of Phase I and Phase II compliance and its impact on a small groups of states, Title IV of the Clean Air Act Amendments of 1990 provides incentives for technological options and additional allowances. To ease the cost of the compliance burden, the Act provides 200,000 allowances to Phase I affected sources in Illinois, Indiana, and Ohio.[25]

The Act also provides a "scrubber" incentives program, and sets aside a reserve of 3.5 million allowances to be allocated in Phase I to those utilities electing to scrub Phase I units;[26] SO_2 emissions must be reduced by at least 90% to receive the bonus allowances. In addition, a two-year compliance extension is permitted for an "eligible extension unit" when a scrubber is installed. For those utilities that scrub in Phase I and are able to reduce SO_2 emissions below 1.2 lbs of SO_2 per MMBtu, 3.5 million allowances are available as "additional" allowances.[27] Those Phase I affected utilities will be able to continue the use of high sulfur coal, with the extra allowances compensating the utility (and possibly ratepayers) for the additional expense of scrubbing.

Phase II also offers several programs which encourage the adoption of certain technological options, and which in part aim at easing the burdens of compliance on affected states and utilities. Conservation and renewable energy sources are offered allowances from a fund containing 300,000 allowances.[28]

More important to states having extensive coal resources are incentives for the development of clean coal technology (CCT).[29] For those units repowering or engaging in "greenfield" CCT construction, extension of Phase II compliance is delayed until the beginning of 2004.[30] In addition, those units that do not increase actual hourly emissions will not incur new source review.[31] Section 415 allows exemption from the "WEPCo" modification doctrine for experimental CCT units. Within the National Energy Strategy, FERC incentives for CCT development are also proposed, including incentive rates of return, accelerated depreciation and other unspecified incentives.

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[25] P.L. 101-549, Section 404 (a)(3).

[26] P.L. 101-549, Section 404(d).

[27] P.L. 101-549, Section 404 (d)(3).

[28] P.L. 101-549, Section 404 (f).

[29] P.L. 101-549, Section 409, Section 415.

[30] P.L. 101-549, Section 409 (b)(2).

[31] P.L. 101-549, Section 409.

Other federal legislation has been proposed to promote the use of scrubbers. Senate Bill 1234 proposes the use of tax credits for power plants adopting scrubbers as a means of mitigating the costs of Title IV compliance. Many states supporting this bill are in the south together along with the traditional high sulfur coal producing states.[32] S.1234 also calls for direct subsidies to aid the Tennessee Valley Authority by purchase of scrubbers and clean coal technology, in order lower compliance cost and preserve mining jobs in the western Kentucky coal fields.

States expected to be negatively impacted by fuel switching have also adopted legislation, which provides incentives for scrubbing, clean coal technology, or mandates the use of state high sulfur coal. Table A.1 indicates the programs enacted by the high sulfur coal producing states to date. Several of the incentives and mandates deserve additional comment about potential trends and affects.

The states of Illinois, Indiana, and Ohio all explicitly require the inclusion of socioeconomic costs (in terms of jobs, effect on the local economy, etc.) for those utilities desiring to switch to out-of-state coal in the computation of their compliance costs (in addition to direct control costs, reliability effects, etc.). This is an important indication of how integrated resource planning may be altered to include more local socioeconomic effects. The impact of the inclusion of these costs will bias control decisions toward scrubbing. In an economic sense, biasing price decisions for the sake of equity is nonoptimal, as all relevant costs should already be included in the prices of the goods being considered. Economics however, has not been, and probably will never be, the overriding factor in policy making.

Unique among these state however is West Virginia's plan to grant an incentive rate of return (IROR) for CCT projects. The use of IROR compensates the CCT project for the additional risks of development and encourages the use of local coal.

[32] See Electric Power Alert (1991), for further details.

Table A.1 High Sulfur Coal States and Response to Title IV

State	Programs
Illinois	Preapproval of scrubber technology CWIP allowed for scrubber installation Mandating scrubber and state coal use at certain facilities
Indiana	Utilities may seek preapproval for acid rain compliance plans CWIP is allowed
Ohio	CWIP for utilities participating in scrubber program Tax incentive for state coal use
Pennsylvania	CWIP for scrubber and innovative technology Utilities may seek preapproval of acid rain compliance plans Tax incentive for state coal use
West Virginia	CWIP for scrubbers and innovative technology construction IROR for CCT projects Accelerated Depreciation for scrubbers and CCT type projects

Source: Illinois Senate Enrolled Act 621; West Virginia Code Chapter 24,-2-1g, Article 2g; Clean Coal/Synfuel 5/6/91; Indiana Senate Enrolled Act 514; and Ohio Senate Bill 143.
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