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With the creation of tradeable sulfur dioxide permits under the Clean Air Act Amendments of 1990, financial markets have been drawn into the effort to achieve targeted air pollution reductions at least cost. As Susan Dudley explains, financial markets will go well beyond simply providing a place to buy and sell permits. These markets will create a variety of "futures" contracts that will enable utilities to manage the risks of planning future strategies to control pollution.

Introduction

Several provisions of the Clean Air Act Amendments of 1990 will have an effect on electric utilities, including the nitrogen oxides (NO_x) provisions of Title I, the hazardous air toxic pollutant provisions of Title III, and the acid deposition provisions of Tide IV. I will describe the framework of the hazardous air pollutant amendments and then discuss the acid rain provisions. In particular, I would like to discuss how utilities can manage uncertainty to realize the cost-saving potential offered by the sulfur dioxide (SO_2) allowance trading program.

Overview of Title III of the Clean Air Act Amendments

Title III of the Clean Air Act Amendments amends Section 112 of the Clean Air Act. It identifies 188 hazardous air toxics and contains three elements: (1) technology-based controls, (2) research studies, and (3) prevention of accidental releases. The costs that will be incurred this decade for control and monitoring equipment to comply with this section have been estimated to be over $19.4 billion (McIlvane Co. 1991).

For most "major sources," which are defined as sources that emit more than 10 tons per year of any hazardous air pollutant or more than 25 tons per year of any combination of hazardous air pollutants, the control requirements of Section 112 involve two phases. First, the Environmental Protection Agency (EPA) must identify the "maximum achievable control technology" (MACT) on a source-by-source basis. Then, after those controls are in place, EPA must report to Congress on any residual risk remaining at each source. For "area sources" (those that are not major), EPA has the discretion to apply "generally available control technologies" (GACT) instead of MACT.

Title III treats separately "electric utility steam generating units," which are defined as fossil-fuel-fired units greater than 25 megawatts that produce electricity for sale. Due to the requirements of other titles, especially Titles I and IV, Congress gave EPA more flexibility in the regulation of utilities than of other sources. Emission controls will be contingent on the results of

studies that EPA will conduct under Section 112(n)(l). EPA must report to Congress on the public health risks that are "reasonably anticipated to occur" after the imposition of other requirements of the Act, and must recommend control strategies for emissions that warrant regulation. Although these studies are due in November of this year, they are not expected to be complete until late 1994 or 1995. While this approach gives utilities some time, it also complicates planning decisions. The possibility that additional requirements may later be imposed to control air toxics, even after massive expenditures to comply with Titles I and IV, will make it difficult to plan efficiently. I will return to planning problems later.

Overview of Clean Air Act Amendments, Title IV

Under Title IV of the Clean Air Act Amendments, EPA will implement mandated sulfur dioxide reductions by allocating in two phases a limited number of "allowances" to plants that currently emit sulfur dioxide. Each allowance will permit an electric utility unit to emit one ton of sulfur dioxide. Allowances will be allocated to achieve approximately a 50 percent reduction in emissions from 1980 levels by the year 2010. The allowed level of emissions will be easier for some utilities to achieve than for others, so the amendments permit allowances to be bought and sold. Most utilities will find that a least-cost strategy involves some combination of (a) using the allowances initially allocated by EPA (e.g., emitting an equivalent number of tons of sulfur dioxide), (b) buying additional allowances from other sources, (c) selling excess allowances, or (d) "banking" them for use in future years. There are no restrictions on who can buy or hold allowances, so brokers, environmental groups, or even private citizens may choose to enter the market.

Economists, who have long advocated market-based solutions to environmental concerns, are encouraged by this experiment in emissions trading. Traditional command-and-control regulation, which would have required each power plant to shoulder its share of the reduction in emissions, might have achieved the same level of emissions reduction, but it could not achieve the reduction as cost-effectively.

To appreciate the advantages of emissions trading over traditional regulation, consider first a theoretical world without other forms of regulation or taxes. Each utility subject to the Clean Air Act Amendments would attempt to minimize its cost of compliance by selecting the optimum combination of emissions reductions (through controls or fuel switching) and purchased allowances. Utilities that faced relatively low costs of reducing emissions would choose to over-comply and would sell excess allowances. Those with higher costs of control would find it cheaper to buy allowances. This cost-minimization behavior by each individual utility would achieve the emission reduction targets at the least cost to society as a whole. The estimated savings over a traditional command-and-control approach are two to three billion dollars each year (Portney 1990).

Unfortunately, we do not live in a world without taxes or regulation and the actual savings achieved will depend on a variety of factors, including (1) biases in rate regulation, (2) tax treatment of allowances, (3) public reaction to allowance purchases, and (4) regulatory and market uncertainties.

The combination of these factors appears to be leading toward over-control of sulfur dioxide emissions. Regulations that discourage allowance purchases, and public pressure for utilities not to buy "rights to pollute" appear to be inhibiting the development of the allowance market. Utilities are responding to incentives to over-control in order to sell excess allowances, but they are finding few buyers for allowances.

Utility regulators may not feel responsible for encouraging an active, liquid allowance market for its own sake, but they should recognize that such a market will benefit ratepayers in the long run. Carefully crafted regulations that reduce biases and provide utilities with incentives to minimize costs will not only serve the best interest of ratepayers, they will also have the side effect of encouraging a robust market in allowances.

Regulatory and market uncertainty

Up-front guidance is important for providing a degree of assurance to utilities before they make compliance decisions. Regulatory uncertainty will be an important determinant of the extent to which the potential cost savings of the allowance trading program are realized.

The traditional approach to rate-making provides utilities with little or no advance guidance, but subjects them to after-the-fact prudence review. This imposes large regulatory risk on the utilities, and this risk is unlikely to provide the right incentives to minimize costs. The risk of *ex-post* review could be aggravated by the existence of a spot market in allowances, because regulators might judge the prudence of past decisions by examining current allowance prices without consideration of the information available at the time the compliance decision had to be made.

Subject only to traditional *ex-post* review, utilities will select what they perceive to be the safest, but not necessarily the most cost-effective, compliance options. A conservative strategy by a utility subject only to *ex-post* prudence review would probably involve installing control equipment rather than purchasing allowances. This concern has led some to encourage commissions to "pre-approve" specific compliance plans, which would remove all regulatory uncertainty from the utility's subsequent actions, as long as they comply with the pre-approved plan. In considering this proposal, it is important to distinguish between regulatory uncertainty and market uncertainty. Regulatory uncertainty involves the risk that evolving regulations will not compensate certain compliance choices (such as purchasing allowances) or that, in the *ex-post* review, decisions will be judged imprudent based on different market conditions, and returns to shareholders for investments that appeared cost-effective at the time of the decision will be disallowed. Market uncertainty, on the other hand, refers to the risk of changes in the supply and demand for allowances, or that more efficient technologies will become available after an investment has been made.

While everyone benefits if regulators reduce regulatory uncertainty, regulators cannot reduce market uncertainty. They can partition risks between shareholders and ratepayers. In the case of allowance markets, both shareholders and ratepayers will benefit if regulators allow utility managers to make business decisions and then to bear the rewards as well as the risks of those decisions. In complying with the Clean Air Act Amendments, the utility is in a better position

than regulators to make the business decisions to minimize market risks and the shareholders are better able than ratepayers to bear those risks.

This differentiation between regulatory uncertainty and market uncertainty tends to argue against pre-approval of specific compliance plans. Such pre-approval would shift all the risks of changing market conditions from shareholders to ratepayers. It would also severely limit the flexibility to respond to changing conditions and will shift responsibility for compliance decisions from utilities to regulators. A variety of instruments are available to minimize or to hedge against market risks, and the utilities themselves are in the best position to take advantage of these instruments.

Another suggested approach, which is a modified form of pre-approval, would specifically endorse trading in allowances, on the grounds that only through an active market can the full cost-saving potential of the Clean Air Act Amendments be realized. While the basis of this recommendation is true, trading for trading's sake is not the way to achieve the greatest cost-savings. Regulators need not adopt as a goal an efficient liquid market in allowances for the market to work. Rather, commissions should adopt up-front guidance that provides utilities the incentives to minimize costs to ratepayers. By allowing market forces to work, regulators will directly benefit their ratepayers while they indirectly encourage an efficient market.

A useful form of guidance might be for a commission to set a benchmark cost of compliance that is based on the current or expected value of allowances. The utility would be allowed to recover compliance costs up to the benchmark value. If its costs exceed the benchmark, utility shareholders would pay the difference (or at least a predetermined share of it). If compliance costs turn out to be lower than the benchmark, the savings would be shared between shareholders and ratepayers at a predetermined rate.

This type of rule provides utilities with incentives to reduce costs below the benchmark and with disincentives to incur compliance costs that exceed the benchmark. It should lead them to choose the least-cost combination of allowances and control, given available information at the time that compliance decisions are made.

Setting the benchmark might be the trickiest part of this rule. It could require extensive analysis by utilities, as well as oversight by their regulators to ensure that the benchmark is not overstated. A liquid futures market in allowances, however, would provide a reliable alternative to such detailed analysis. As I will discuss below, an active futures market would send a clear signal that the future value of allowances will be based on the collective wisdom of all market participants.

Managing market uncertainty

Although incentive regulation, such as benchmark costs, would help reduce the regulatory uncertainty that currently seems to be inhibiting the market, it would not (and should not) eliminate all risk. Utility managers will still have to deal with significant market uncertainty.

Unusual weather conditions may affect consumer demand for electricity, scrubbers may be less reliable than expected, or the price of allowances may turn out to be higher (or lower) than predicted. Creating further uncertainty, entities that emit sulfur dioxide, but which are not subject to mandatory coverage by the amendments, may choose voluntarily to comply with the acid rain provisions and to receive allowances from EPA. Such sources, which could include small utilities and industrial boilers, would presumably choose to participate only if the credit they expect to receive (i.e., the allowances) exceeded their obligation. On net, therefore, their participation will increase the supply of allowances. This has important implications for utilities, because it means that the supply of allowances is not fixed. As the price of sulfur dioxide allowances increases, more sources will choose to "opt-in" to the market, which will thereby limit the potential for upside price movement.

Potential EPA actions can also complicate utilities' strategic planning decisions. Possible future requirements to control air toxics add significant uncertainty to the planning process. And, Title IV contains various provisions that would allow EPA to withdraw permits from the market or allocate more to certain sources, which will make it difficult to anticipate ultimate supply and demand. Recent petitions for court review of EPA's emission trading rules raise additional uncertainties about the viability of the allowance market.

Because the future of compliance costs and allowance prices are so uncertain, a simple objective of minimizing the net present value of revenue requirements under a "most likely" scenario may not really achieve a least-cost solution. Net present value calculations do not account adequately for the value of flexibility. Flexibility is important to respond to regulatory and market uncertainty. For example, under a most likely scenario, installing scrubbers and selling allowances might be the least-cost option. However, there is also some probability that "opt-in" sources will cause the price of allowances to fall enough that purchasing allowances would be a better solution or that future regulations under Section 112 will mandate new technology-based controls. With these possibilities, there may be a positive value in keeping the utility's options open, rather than investing immediately in scrubbers. Option valuation methods, which view a compliance strategy as a series of decisions with options at each decision node, can place a value on flexibility more explicitly than traditional net present value calculations (See Graves *et al* 1989; and Graves and O'Loughlin 1991).

While uncertainty is not a new phenomenon to utility planners, the existence of the allowance market complicates planning decisions. Unlike other compliance tools at the utility's disposal, allowances are financial assets. They do not depreciate in value (unless supply and demand conditions change). They can be bought and sold freely, or even banked for future use. Thus, they add a twist to the typical engineering-based analysis of uncertainty that utilities usually perform.

Fortunately, as financial assets, allowances open up new opportunities for hedging against future uncertainty. New forms of "insurance" are available to utilities that wish to reduce their risk. Because allowances are financial instruments, financial intermediaries can offer a variety of packages to shift risks away from a utility's shareholders and ratepayers. Perhaps even more unusual for utility planners, commodities exchanges have introduced futures and options

contracts in allowances, which should provide valuable hedging tools, if and when active trading begins.

Customized 'insurance' packages

Financial institutions are in the business of creating customized contracts to transfer risks, and such contracts are negotiated all the time in other business areas. Forward contracts allow the owners to lock in a future purchase or sale at a price agreed upon today. Options give the buyer the right, but not the obligation, to buy or sell an asset at a future date at an agreed upon price. Swaps are individually negotiated transactions, similar to forward contracts, used routinely in commodity and financial markets to shift risks. A utility that entered into an allowance swap, for example, might agree to make a series of fixed annual payments in return for receiving a series of payments linked to the price of allowances. This would guarantee the utility that, for a price negotiated today, it would have the money to buy allowances in the future, whatever happened to allowance prices.

Such customized insurance packages are likely to be available regardless of how active the market in allowance trading becomes. However, the less liquid the market, the more expensive this type of insurance will be.

The futures and options market

The Chicago Board of Trade, the oldest and largest commodities exchange, has announced that it will begin trading in "clean air futures" and options on those futures in the second half of this year. Futures markets have been used for over a century to reduce price risks associated with unanticipated changes in supply and demand. A futures contract commits two parties to exchange the underlying commodity (in this case, twenty-five sulfur dioxide allowances) at a given price on a specified future date. An option on a futures contract gives the purchasing party the right, but not the obligation, to buy (a call option) or sell (a put option) the underlying futures. Because all commitments are guaranteed by the futures exchange, the credit risk or even the identity of the other party to any trade is irrelevant to market participants. Unlike individually brokered commitments between two parties, futures commitments in liquid markets are easy to "unwind"; one simply executes an offsetting transaction. In fact, the underlying commodity in a futures transaction is rarely delivered. In contrast to the "cash market," where the sum of all allowances is equal to those issued by EPA minus those consumed to date, the sum of all long and short futures contracts is always zero. As expiration day approaches, market participants unwind their positions.

These characteristics of futures markets are likely to make clean air futures a low cost way to hedge against the inevitable uncertainty in supply and demand forecasts. For example, to hedge against the possibility of an increase in demand for allowances, a utility could buy futures at a price determined today, which will make it easier to plan operations and to determine prices with more certainty.

Utilities will not be the only beneficiaries of these futures markets. Brokers and other participants in the allowance trading market will find futures markets valuable for hedging.

Moreover, anyone who believes that prices do not properly reflect underlying supply and demand can take an unhedged position, which is far easier to do in a liquid futures market than in the cash market. Even those who do not participate directly in the futures market are likely to benefit from its existence. First, because futures prices are widely reported and readily accessible, the market price for sulfur dioxide allowances will be more easily observed in the futures market than from reports of prices negotiated between private parties. Utility regulators could use futures prices in determining benchmarks for incentive regulation, or they could use past futures prices to evaluate the prudence of a utility's past decisions. Utilities could use prices to help anticipate future compliance costs. Moreover, research has indicated that futures markets tend to make the underlying market more efficient and less volatile.

Examples of planning and hedging for uncertainty

I will close with three examples of how thinking of allowances as financial assets can aid in hedging uncertainty. These scenarios assume that the utility's regulator has already minimized the regulatory risk through guidance designed to give the utility incentives to keep compliance costs down. The first two examples are purely hypothetical. The third is based on a proposal made by PSI Energy in Indiana.

Utility A

Utility A's planning for Phase II compliance indicates that, without some action, it will face an allowance shortfall (i.e., its allocated allowance will be less than emissions). It could install a scrubber to reduce its emissions, but best estimates indicate that the cost of scrubbing will be greater than the cost of purchasing allowances. Moreover, Utility A's managers are concerned that if current scrubber technologies do not adequately control air toxics, they may have to install additional controls at a later date. Based on its projections, the utility would like to adopt a wait-and-see approach for installation of controls, because it will be best to buy allowances in the year 2000 if circumstances do not change.

Utility A's regulator has reviewed its projections and agreed that, as long as allowances are purchased at prices that are within a certain band, it will consider the utility's allowance purchase strategy to be prudent. The regulator will allow the savings achieved by purchasing allowances rather than installing controls to be shared between shareholders and ratepayers. If allowances must be purchased at prices above the specified range, however, the difference in price will be disallowed.

If it waits until the year 2000 to buy allowances, Utility A runs the risk that prices will rise above the allowed range and that its shareholders will thereby take a loss. It could buy allowances today and bank them, or enter into a forward agreement to buy them at a guaranteed price in the future. While either of these strategies would protect it against upward price movement, they would also eliminate potential gains from downward price movement. A third strategy would be for Utility A to buy the right (but not the obligation) to purchase the needed allowances in the year 2000 at a certain price. This would ensure that it would not pay more than the upper bound set by its commission, but would allow it to gain if allowance prices fell by the year 2000.

If futures and options markets are liquid, Utility A could enter the market directly to buy a combination of futures and options contracts. The futures would lock the utility into buying a number of allowances at a future date and the options would give it the right to buy other allowances, all at an agreed upon price. Alternatively, financial institutions could respond to Utility A's needs by offering a package of brokerage and "insurance" services tailored to the utility's regulatory constraints and risk preferences. The package could include (1) the purchase of some contracts in the spot market, (2) a forward contract for some allowances, and (3) a "call option" for the remainder.

Utility B

Utility B has allowances to sell. It could sell a stream of allowances today, or it could wait to sell future allowances when they are allocated. Its commission has set a minimum price, below which the utility's decision to delay the sales will not be deemed prudent, *ex post*. Above that minimum price, the utility may keep fifty percent of the net revenue from the sale of allowances.

Utility B would like a package of brokerage and insurance services that includes sales of allowances on the spot and forward markets, plus a "put option" for some allowances. The put option would guarantee Utility B a minimum sale price if allowance prices fall, but would still allow it to enjoy upside price movements.

PSI Energy

PSI Energy in Indiana proposed that its regulators approve an incentive proposal for Phase II compliance. The proposal would allow shareholders to keep fifty percent of any difference between (1) avoided compliance costs and (2) allowances costs, if that difference exceeds twenty percent of allowance costs. If allowance costs ultimately exceed avoided compliance costs, shareholders would not fully recover their expenditures. Since the avoided compliance costs are defined as those anticipated when allowances are purchased or when a decision is made to forego own-system compliance, PSI will bear the risk that allowance prices increase after it makes a commitment not to invest in equipment.

If PSI's regulators accept such a proposal (which is far from assured), how should PSI maximize returns to shareholders? Ideally, PSI would like to maintain the flexibility to profit if allowance prices fall, but would also like to minimize the risk of prices rising to the point that its shareholders face a loss. A good hedging strategy would involve (a) purchasing allowances, futures, or forward contracts when prices go below a certain level (defined in relation to expected compliance costs), and (b) purchasing an insurance component (a call option) that would give PSI the right to buy allowances at a certain price (defined as the upper bound of avoided compliance cost). It is possible that standardized futures or options contracts may not be able to meet PSI's needs, due to illiquidity or the long time horizon of the utility's decisions, but financial institutions will certainly be willing to offer brokerage services that include forward and option contracts, for a price.

Each of these scenarios combines spot and forward transactions with an option purchase. More complex packages might include more than one option component (if, for example, a utility

wanted to pay for downside "insurance" by selling off upside potential), or "swaps." (In financial markets, people also negotiate forwards on swaps, options on swaps, callable swaps, and putable swaps.)

Conclusions

Title IV of the Clean Air Act Amendments offers the opportunity to achieve the reduction in sulfur dioxide emissions at significant cost savings over traditional command-and-control regulation. There are obstacles to achieving maximum savings, however. Biases and uncertainties inherent in *ex-post* prudence review can be managed if regulators adopt incentive regulations that provide up-front guidelines on how compliance decisions will be evaluated. Providing utilities with incentives to minimize costs is the key to protecting ratepayers and to ensuring an efficient market in allowances.

Market uncertainties can also complicate the market. However, regulators are not in a good position to reduce these. Efforts by regulators to reduce market uncertainty are likely to lead to ineffective micro-management, which can aggravate regulatory risk without reducing the external sources of market risk.

Because emission allowances are financial assets, they offer a variety of new tools to handle risk. These tools, which include both contracts on commodities markets and also individually negotiated contracts, are best used by utility managers to insure against losses from unexpected price movements.

References

Graves, Frank C. and Matthew P. O'Loughlin. 1991. "Projecting Financial Integrity in CAAA Compliance: Analytic, Strategic, and Regulatory Responses."

Graves, Frank, James A. Read, Jr., and Paul Carpenter. 1989. "Estimating the Cost of Switching Rights on Natural Gas Pipelines," *The Energy Journal*: Vol. 10, No. 4.

McIlvane Co., 1991. Air Toxics and VOCs: Markets and Technology for Compliance Analysis, Control and Measurement, a market forecast (See reference in *Clean Air Report*, Dec. 5, 1992, p. 18.)

Portney, Paul R. 1990. "Economics and the Clean Air Act" *The Journal of Economic Perspectives*. Vol. 4, No. 4 (Fall 1990), p. 175.

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