CHAPTER IV

REDUCING SULFUR DIOXIDE LEVELS WITH EMISSION TAX AND SUBSIDY PROGRAMS

Chapters II and III explored means to reduce sulfur dioxide emissions using the traditional system of requiring and enforcing emission limits on specific sources, often called the "command and control" approach. This chapter examines another method: reducing sulfur dioxide emissions from electric utilities by charging a tax (or fee) on each ton of SO_2 emitted. In addition to giving utilities a financial incentive to limit emissions, the tax would generate revenues that could be used to influence the choice of abatement method by providing subsidies for utilities that install scrubbers. Although subsidies would raise total program costs, they would also encourage additional emission reductions, lower the costs borne by utilities and consumers, and maintain the use of high-sulfur coal.

The CBO examined two basic emission tax schemes: a tax program without a subsidy for scrubbing, and a tax program in which subsidies--drawn from the tax revenues--would be given to utilities that install scrubbers (see Table 25). A simple tax option without subsidies would lower utility emissions primarily through fuel switching. For example, a $600 per ton SO_2 tax levied on older, state-regulated utility sources (Option IV-1) would lower projected total annual emissions in 1995 from 18.5 million tons under current policy to 10.0 million tons, and would provide $4.9 billion in annual revenues as of 1995.[1] The SO_2 tax would be relatively cost-effective at $327 per ton of SO_2 removed compared with the 10 million ton polluter pays reduction with no fuel restrictions (Option II-2A), which would cost $360 per ton. The simple tax would, however, allow slightly more emissions.[2] The total program cost of Option IV-1 over the 1986-2015 period would also be somewhat higher than Option II-2A--$37.5 billion compared with $34.5 billion, respectively (in discounted 1985 dollars). The cost-effectiveness measure, however, captures the benefits from emission reductions that would occur earlier than 1995--the compliance deadline governing previous op-

1. As is true for the options examined in Chapters II and III, it is assumed that the alternatives in this chapter would not apply to newer utililties that must conform to the New Source Performance Standards.

2. For easy reference, all options in this report are defined in the glossary at the end of the paper.

tions--which are ignored in the total program cost calculation. These benefits derive from the assumption that utilities would respond more quickly to an immediate annual financial penalty than to a relatively distant compliance date, thus incurring abatement costs earlier. Finally, Option IV-1 would provide about 4,000 more mining jobs in 1995 in Illinois, Indiana, Ohio, and Pennsylvania than expected under Option II-2A.

CBO also examined two subsidy schemes to accompany the $600 per ton SO_2 tax: Option IV-2 would grant a 90 percent subsidy for the cost of purchasing and installing a scrubber, and Option IV-3 would combine a 50 percent subsidy for operation and maintenance with the 90 percent capital subsidy for scrubbers. Options IV-2 and IV-3 would lower 1995 SO_2 emissions to about 9.6 million tons, while providing $4.7 billion in annual tax receipts in 1995. These subsidies would raise toal discounted program costs to $39.2 billion with Option IV-2 and $45.9 billion with Option IV-3. Unlike the programs that combine scrubber subsidies with specific emission targets, however, these scrubber subsidies also would encourage additional emission reductions above those resulting from the tax. These additional reductions would make Option IV-2 at $317 per ton removed, almost as cost-effective as Option IV-1. The additional subsidy granted under Option IV-3 would result in higher costs with nearly the same emission levels as Option IV-2, thus raising the cost per ton abated to $384.

TABLE 25. EMISSION TAX OPTIONS

Policy Option	Resulting Emission Reduction from 1980 Levels	Tax System	Scrubber Subsidies
Option IV-1	9.2 million tons	$600/ton ($.30/lb.) tax on SO_2 emitted from pre-NSPS coal- and oil-fired sources	None
Option IV-2	9.5 million tons	Same as above	90 percent annual cost of capital
Option IV-3	9.6 million tons	Same as above	90 percent annual cost of capital, 50 percent annual cost of O&M

SOURCE: Congressional Budget Office.

In addition to reducing emission levels, these subsidies also would lower the net costs to the utilities and ease the electricity rate increases expected under the SO_2 tax. This would be especially evident in the Midwestern and Appalachian states which would incur the largest share of the abatement costs, and would still pay a large portion of the taxes collected even after reductions occur. Scrubber subsidies also would promote high-sulfur coal production and employment in Illinois, Indiana, Ohio, and Pennsylvania. Compared with Option II-2A, 1995 mining employment in those states would be greater by 9,000 jobs under Option IV-2 and by over 13,300 jobs with Option IV-3.

RATIONALE FOR AN EMISSIONS TAX

Effluent taxes possess many economic advantages over the traditional command and control style of environmental regulation. Advocates of this approach usually invoke the microeconomic theory of external cost to frame their arguments. 3/

External cost is defined as the difference between the private cost of producing a commodity--the market value of the resources devoted to its production--and the social cost of producing that good--which includes the cost of any environmental damage. If producers minimize only private cost in making decisions, then their actions can impose an additional (external) cost on society for which they pay nothing. In this context, the market price no longer reflects the true resource cost of producing that good, and the competitive market no longer leads the economy to the desirable point of maximum efficiency. A tax levied on emissions, if properly specified, can allow the competitive market to "regulate" pollution in a theoretically simple fashion. When producers are forced to pay the full social cost associated with their output, then the incentive to minimize production costs will include the incentive to reduce pollution. Producers will employ the most economically efficient methods of pollution abatement (for example, investing in additional control equipment, changing the input mix, or reducing output) until the costs incurred by abating another unit of pollution outweighs the tax that they must pay to emit that unit. If the tax truly captures the external cost of production, then the resulting levels of output and effluent would be socially optimal.

---

3. See, for example, Frederick R. Anderson and others, *Environmental Improvement Through Economic Incentives* (Baltimore: The Johns Hopkins University Press, 1977).

The strict theoretical case for effluent fees requires that the regulators correctly estimate the monetary value of pollution damage from each source, and set taxes for individual plants accordingly. In the case of acid rain, however, the precise cause and extent of pollution damage remains uncertain. Therefore, only a nationwide uniform tax rate is considered here, and its level is largely determined by the amount of emission reductions it can achieve.

Regulators should also have extensive information about producers in order to set the tax to achieve a certain level of emissions. Although some uncertainty remains about the effect of tax rates on emission levels, an emissions tax can simplify the administrative task of attaining approximate emission targets because the regulators no longer have to identify those sources with the lowest-cost abatement opportunities. An emission tax allows individual emitters to decide the cheapest abatement strategy for themselves. The emissions that remain come from the plants that face the highest additional control costs; their tax payments constitute a true "polluter pays" fee for the remaining emissions.

Emissions Taxes as Financial Incentive Versus Simple Revenue Sources

A true emission tax, designed to reduce pollution output, should be distinguished from a simple revenue-raising tax that uses emissions as a tax base. Examples of the latter can be found in the Federal Republic of Germany's water discharge fees--used to finance local treatment plants--and in Japan's SO_2 emission taxes in selected urban areas--used to compensate victims of illnesses related to air pollution.[4] In the United States, a proposal introduced into the 98th Congress (S. 2001) by Senator Durenberger would have levied a temporary tax on sulfur dioxide and nitrogen oxide emissions from all major stationary sources. This tax was meant to provide revenues of $40 billion dollars over 10 years for scrubber subsidies. S. 2001 stipulated that only two-thirds of the revenues would originate from SO_2 taxes. Since utilities emit roughly two-thirds of the SO_2 emitted nationwide, they would have provided $18 billion of the total revenues. Taxes on other stationary sources of SO_2 and nitrogen oxide, as well as mobile sources of nitrogen oxide, would provide the remainder ($22 billion). The SO_2 reductions required in S. 2001 would not be motivated by the tax,

4. See Congressional Budget Office, *Environmental Regulation and Economic Efficiency* (March 1985) for a discussion of these policies, which have typically applied low rates to broad tax bases. While such policies may provide some incentives to control pollution, the primary goal is the collection of revenue.

but instead would be dictated by the excess emission formula (applied to the 31 eastern and midwestern states), in the same way that the options examined in Chapters II and III allocated state reduction targets.

Taxing SO_2 emissions from electric utilities could provide about $18 billion after 10 years with a tax of about $100 dollars per ton on all power plants, assuming that utility emissions hold steady in the interim. Such a small tax, however, probably would not affect utility decisions regarding emissions control. This proposal is similar to Option III-2B described in the last chapter, simply replacing a generation tax with an emission tax to subsidize scrubber installation and use. The fundamental difference lies in the geographic distribution of the tax burden: S. 2001 would have concentrated the tax burden in the states where emission rates are currently high, whereas the generation fee policies would spread much of the tax burden over other states. Thus, S. 2001 was neither a punitive emission tax nor a policy designed to spread costs geographically, but rather an extension of the polluter pays idea with an emphasis on scrubbing. Moreover, the ratio of administrative expenses to revenues raised would likely be high, even allowing for the relative ease of assessing SO_2 taxes on electric generating plants. Therefore, the remainder of this chapter is devoted to examining tax policies which rely on an emission tax rate high enough to encourage abatement without additional regulatory intervention.

Administrative Issues

The relatively uniform characteristics of electric generating plants would allow regulators to monitor compliance and determine tax liabilities. The relationship between the efficiency of a plant, the sulfur and heat content of the fuel burned, the generation of power, and the resulting emissions are straightforward and can be calculated with information that the utilities already must file with various regulatory agencies. In the absence of continuous emission monitoring, the administrators of a tax system could rely on standard formulas to calculate taxable emissions. While some uncertainties will always exist, such as the reliability of scrubbers, these would be present under any system of regulation designed to reduce utility emissions. Because much standardization exists in the industry, a broad-based formulaic approach to assessing annual taxes could be devised. The burden of proof that an estimating procedure does not faithfully represent a particular plant could rest with the utility.

Because there are relatively few generation plants, the administrative costs of assessing and collecting a sulfur dioxide tax from electric utilities would be small relative to revenues collected. As of December 1984, there

were 1,300 coal-fired electric utility boilers in commercial operation.[5] In 1985 these boilers emitted a total of 15.2 million tons of SO_2--for an average of 11.7 thousand tons per unit. With a tax of $600 per ton of SO_2, average annual revenues per source would equal $7.0 million before any reductions occurred.[6]

Cost Passthrough Issues. To encourage emission reductions in the absence of prescriptive regulations, emission tax rates would have to be high enough so that a substantial number of firms could lower total costs if they reduced pollution. To ensure maximum emission reductions from an emission tax, the tax would have to be permanent, because utilities might simply pass the costs of a temporary tax through to consumers and wait until the tax expires. Without the threat of continued tax payments, the rewards of developing a long-run abatement program might disappear, since future abatement actions would not lower emission tax payments.

For an emission tax to work, incentives would have to be present for firms to minimize production costs. In the unregulated market, competition provides this incentive. In the regulated market of the electric utility industry, however, the state public utility commissions, charged with setting electricity rates, would have to ensure that costs are minimized. The commissions would need to review utility decisions to determine that emission reductions programs were cheaper than the cost of the tax. Otherwise, the utilities might choose to pay the tax and pass most of the payments on to consumers in the form of rate increases. Of course, even if utilities implemented a cost-effective abatement plan to avoid the punitive emission tax, the taxable emissions that remain would still raise generation costs. State commissions should allow utilities to raise electricity prices to reflect this legitimate additional operating expense.

EMISSION TAX APPROACHES

The CBO used a modified version of the National Coal Model (introduced in Chapter II and described in the appendix) to predict the effects of a national emission tax. The emission tax is simply a charge levied on a utility plant for each unit of SO_2 it emits while generating electricity. Utilities

5. See Department of Energy, Energy Information Administration, *Inventory of Power Plants in the United States 1984* (July 1985).

6. This calculation is only approximate, since some of these boilers were built under federal regulations and, thus, would be exempt from a tax levied only on older, state-controlled sources.

trying to minimize the total cost of supplying electricity may chose among plant types and among fuels of various heat and sulfur contents. A value of $600 per ton (in 1985 dollars) of SO_2 emitted from power plants subject to state regulations was chosen to obtain an emissions reduction roughly comparable to the 10 million ton polluter pays option (Option II-2A).

Sulfur Dioxide Emissions Under an Emission Tax

A key determinant in setting the level of an emission tax is the relationship between the tax rate and ultimate emission level. The CBO estimates that a permanent $600 per ton SO_2 tax would reduce the projected annual emissions from electric utilities in 1995 from 18.5 (current policy) to 10.0 million tons (Option IV-1). When this tax is combined with a 90 percent capital subsidy for retrofit scrubbers (Option IV-2) or a 90 percent capital and 50 percent O&M subsidy (Option IV-3), emissions are further reduced to an annual level of 9.6 million tons in 1995. Table 26 shows the utility SO_2 emissions under the three tax and subsidy programs.

The emission tax and subsidy policies yield a 1995 level of total emissions slightly higher than Option II-2A. The distribution of the emissions, as expressed by the percentage of the total reduction originating from each state under the tax policies, is nearly identical to the distribution mandated by the standard excess emission formula. For example, six states account for 59 percent of the emission reduction under Option II-2A: Illinois, Indiana, Missouri, Ohio, Pennsylvania, and West Virginia. Under the tax policies, this share remains virtually constant at about 60 percent.

The excess emission formula is designed to penalize most heavily the states with high emission rates in the belief that the least expensive reduction opportunities can be found there. The finding that a uniform nationwide emission tax would elicit a distribution of reductions that is quite similar suggests that the excess emission formula has substantial merit as a method of identifying the appropriate regions. Of course, the tax retains its advantage over the allocation formula in intrastate reductions, since regulators would not have to identify the actual plants within regions with the least costly reduction opportunities. [7]

---

7. Unfortunately, the model employed by CBO cannot fully capture the potential for intraregional efficiency gains implied by using an emission tax compared with prescriptive emission targets, since the intraregional costs are minimized in either case. See the appendix for a more detailed description of the model.

TABLE 26. EMISSIONS UNDER THREE EMISSION TAX OPTIONS COMPARED WITH A POLLUTER PAYS ROLLBACK OF 10 MILLION TONS, BY STATE (In thousands of tons of SO_2 emitted in 1995)

State	Base Case	10 Million Ton Rollback Option II-2A	Option IV-1	Option IV-2	Option IV-3	Difference from 10 Million Ton Rollback (Option II-2A) Option IV-1	Option IV-2	Option IV-3
Alabama, Mississippi	704	414	479	466	435	65	52	21
Arizona	122	106	106	106	122	0	0	17
Arkansas, Oklahoma, Louisiana	336	302	311	310	310	9	8	8
California	25	25	25	25	25	0	0	0
Carolinas, North and South	1,063	577	532	522	512	-45	-54	-65
Colorado	92	94	87	87	88	-7	-7	-6
Dakotas, North and South	105	105	105	104	96	-1	-1	-9
Florida	772	566	561	547	541	-4	-19	-24
Georgia	635	352	327	327	324	-25	-25	-28
Idaho	0	0	0	0	0	0	0	0
Illinois	1,142	408	488	490	492	80	82	84
Indiana	1,433	533	601	593	593	49	41	40
Iowa	326	167	155	145	148	-12	-22	-18
Kansas, Nebraska	174	163	149	149	149	-14	-14	-14
Kentucky	796	466	480	436	432	15	-29	-34
Maine, Vermont, New Hampshire	64	44	39	35	35	-5	-9	-9
Maryland, Delaware	371	189	223	223	223	34	34	34
Massachusetts, Connecticut, Rhode Island	305	219	306	306	306	87	87	87

(Continued)

TABLE 26. (Continued)

State	Base Case	10 Million Ton Rollback Option II-2A	Option IV-1	Option IV-2	Option IV-3	Difference from 10 Million Ton Rollback (Option II-2A) Option IV-1	Option IV-2	Option IV-3
Michigan	598	374	368	355	355	-6	-20	-20
Minnesota	230	146	136	123	121	-10	-23	-24
Missouri	1,257	293	255	268	295	-38	-25	1
Montana	71	68	68	68	68	0	0	0
Nevada	90	80	74	75	75	-6	-5	-5
New Mexico	62	62	62	62	62	0	0	0
New York (Downstate), New Jersey	270	245	250	254	254	5	9	10
New York (Upstate)	343	141	209	213	213	68	72	72
Ohio	2,017	629	728	689	692	99	60	62
Pennsylvania	1,439	578	769	584	582	191	6	4
Tennessee	761	281	337	332	332	56	51	51
Texas	586	567	586	586	545	19	19	-22
Utah	87	61	71	70	70	10	8	8
Virginia, District of Columbia	213	175	189	189	190	14	14	15
Washington, Oregon	111	104	112	103	97	8	-1	-8
West Virginia	1,042	421	435	435	446	14	14	25
Wisconsin	746	199	285	285	283	86	86	84
Wyoming	69	70	70	69	68	0	0	-2
U.S. Total	18,455	9,241	9,977	9,631	9,576	737	391	336

SOURCE: Congressional Budget Office.

These three tax cases show that increasing subsidies for scrubbers--in the presence of an emission tax--might eventually become ineffective at inducing further reductions, although that point might only be reached with fairly high subsidy levels. The value of subsidies for lowering costs to utilities and encouraging the use of high-sulfur coal remain, of course, even when no further emission reductions occur.

Emissions in the Midwest and the East. The four largest emitting states in the Midwest--Illinois, Indiana, Ohio, and Missouri--would reduce emissions dramatically under each tax option. These four states currently account for one-third of nationwide utility emissions. In each case, this region would reduce expected emissions in 1995 by 65 percent--from over 5.8 million tons to about 2.1 million tons, although individual state levels vary among policies. Scrubber use in these four states would increase substantially if subsidies were granted, but overall emissions would remain fairly constant because of increased reliance on high-sulfur coal compared with the tax-only Option IV-1.

The Appalachian states of Kentucky, Pennsylvania, and West Virginia would also reduce SO_2 emissions drastically under each of the tax schemes. Under Option IV-1, emissions in this region would be reduced from 3.3 million tons to 1.7 million tons per year as of 1995. Adding a 90 percent capital subsidy (Option IV-2) to the tax program would reduce emissions further to 1.5 million tons annually. Most of this additional reduction would come from the state of Pennsylvania, which would increase scrubber use from 24 percent of existing coal-fired capacity in 1985 to 85 percent by 1995. The addition of a 50 percent O&M subsidy (Option IV-3) would induce no additional reductions in this region, even though scrubber use would rise slightly in West Virginia.

A closer look at the distribution of emissions in these regions yields a seemingly counterintuitive result--emissions in some states could actually rise as subsidies for scrubbers became available or were increased. Missouri provides an example of this phenomenon. Under the simple emission tax, buying expensive low-sulfur coal from Wyoming would be cheaper than using scrubbers for many Missouri utilities. When a 90 percent capital subsidy is included, or when O&M is subsidized as well, however, some plants would switch to midwestern coal with roughly five times the sulfur content, while installing enough scrubbing capacity to remove only three quarters of the additional SO_2. Emissions (and taxes), thus, would be higher, but the additional cost of the taxes would be more than offset by the combination of using subsidized scrubbers and very inexpensive nearby coal. While most regions would respond to additional scrubber subsidies by reducing emissions, the effect described here is prevalent enough nearly to offset those reductions. This explains why 1995 utility emissions under Option IV-3

are only slightly lower than under Option IV-2, even as scrubber use increases substantially.

Emissions in the West. In the absence of any policy changes, sulfur dioxide emissions from utilities in the West (states west of the Mississippi, except Minnesota, Iowa, and Missouri) will rise from 1.3 million tons in 1985 to 1.9 million tons by 1995. This increase would be only slightly checked under the three tax policies, each of which would result in western emission levels of about 1.8 million tons by 1995. The taxes and subsidies would have little effect for two reasons. First, many existing plants in the West are already subject to very stringent state emission standards, and historically have burned very low-sulfur western coal, gas, or oil. The remaining emissions come from new sources that are subject to the current federal New Source Performance Standards (NSPS) and would be exempted from the emission tax. Therefore, very few economical opportunities exist for marginal reductions, even in the presence of a $600 per ton penalty for emitting SO_2.

The Cost of Emission Tax and Subsidy Options

Comparing the costs incurred under the financial incentive policies (Chapters IV and V) with those incurred under the targeted rollback schemes (Chapters II and III) requires care, since the assumed timing of costs and emission reductions differ markedly. Specifically, CBO assumes that utilities will respond more quickly--both in reducing emissions and in incurring costs--in their efforts to reduce emission tax payments, compared with simply meeting the 1995 compliance deadline assumed in previously discussed options. Therefore, the cost-effectiveness figure--which takes into account both the timing of emission reductions and costs--becomes a more valid comparative measure, since society presumably attaches a greater value to earlier emission reductions.

Using the net present value measure, the total program cost of Option IV-1 over the period from 1986 through 2015 would be $37.5 billion (in discounted 1985 dollars).[8] Corresponding figures for Option IV-2 and Option IV-3 are $39.2 billion and $45.9 billion, respectively. Table 27 displays these results along with the program cost of $34.5 billion for Option II-2A.

In contrast, the cost-effectiveness figures, by accounting for the discounted stream of emission reductions, suggest that the tax policies would be more efficient than traditional rollback schemes, even when combined with partial subsidies for scrubbers. Table 27 shows that Option IV-1 would

8. Present value is defined in the box on page 19.

cost $327 per ton annually of SO_2 abated, while Option II-2A would cost $360 per ton. The additional reductions occuring from the scrubbing subsidy granted in Option IV-2 would nearly offset the additional costs incurred, and only increase the cost-effectiveness figure to $330 per ton abated, while Option IV-3 would cost $384 per ton abated.

Cost to Utilities. The annual net utility cost in 1995 under a $600 per ton tax on SO_2 would be $7.7 billion higher than the cost under current policy (the base case). The subsidies for scrubbers in Option IV-2 and Option IV-3 would lower this additional cost to $7.2 billion and $6.4 billion, respectively. These costs are significantly higher than those in other proposals because they include the $4.9 billion collected in annual tax payments with Option IV-1 and the $4.7 billion collected under Option IV-2 and Option IV-3. Table 28 compares the 1995 costs under the three tax policies with the costs of the base case and Option II-2A.

TABLE 27. COMPARISON OF TOTAL PROGRAM COSTS AND COST-EFFECTIVENESS OF THREE EMISSION TAX OPTIONS WITH A POLLUTER PAYS ROLLBACK OF 10 MILLION TONS

	10 Million Ton Rollback Option II-2A	Option IV-1	Option IV-2	Option IV-3
Total Program Cost (In billions of discounted 1985 dollars) a/	34.5	37.5	39.2	45.9
Cost-Effectiveness (In discounted 1985 dollars per ton of SO_2 reduced) b/	360	327	330	384

SOURCE: Congressional Budget Office.

a. Reflects net present value of sum of program costs incurred from 1986 through 2015, discounted to 1985 dollars. These costs consist of real annual utility expenditures in excess of current policy, which is equivalent to net utility cost, plus subsidies, minus taxes paid. A real discount rate of 3.7 percent was used in the calculations.

b. Represents the discounted program costs, divided by the annual discounted SO_2 reduction from current policy measured over the 1986-2015 period.

The distribution of net utility costs under the tax policies would vary across regions in a manner similar to the distribution of emission reductions, with the midwest and Appalachian states bearing a large proportion of these costs under each option. These regions would not only incur heavy abatement costs, but also pay a substantial portion of the 1995 emission taxes even after reductions occur. The six states that contribute 60 percent of the emission reductions (Illinois, Indiana, Missouri, Ohio, Pennsylvania, and West Virginia) would incur between 30 percent and 33 percent of the net utility costs under the tax policies; these states also contribute about 36 percent of total tax revenues collected in 1995. Although many of the costs are concentrated in this region, utilities there would also receive most of the subsidies--88 percent of the total subsidies granted under Option IV-2, and 63 percent of the total granted under Option IV-3.

The amount spent on retrofit scrubbers would vary substantially among the three cases. Under Option IV-1, utilities would spend only $34 million in additional annual capital costs for retrofitting existing plants with scrubbers. Thus, the emissions would be reduced primarily by switching to lower-sulfur coals. In Option IV-2, the utilities would increase these annual capital payments to $513 million, of which $462 million, or 90 percent, would be covered by government subsidies. Option IV-3 also would add O&M subsidies of $464 million per year. The addition of a 50 percent O&M subsidy for retrofits would bring annualized capital expenditures for retrofits up to $977 million, of which the subsidies would pay for $879 million per year. Thus, the additional O&M subsidy would encourage the utilities to spend greater amounts on installing scrubbing capacity since the overall costs of operation would be lowered.

Scrubber subsidies would lower net utility costs in most regions, with a few exceptions. In some areas, total generation costs would rise simply because the areas produced more electricity than they needed and transmitted the surplus to meet demand in another location. In other areas, generation would remain constant, but the increased nationwide scrubber use could raise the price of high-sulfur coal to plants (mostly built under the NSPS) that already employ scrubbing. This price rise would not overcome the cost advantage of high-sulfur coal, but simply would make it more expensive.

Electricity Rates Under an Emission Tax Policy

To the extent permitted by state public utility commissions, electric utilities would pass additional tax and abatement costs through to the final consumers through electricity rate increases. This link would depend on pooling (interregional transmission) and the treatment of capital and variable costs in determining revenue requirements for each utility region. In

TABLE 28. ANNUAL UTILITY COSTS AS OF 1995 OF THREE EMISSION TAX OPTIONS COMPARED WITH A POLLUTER PAYS ROLLBACK OF 10 MILLION TONS, BY STATE (In millions of 1985 dollars)

State	Base Case	10 Million Ton Rollback Option II-2A	Option IV-1	Option IV-2	Option IV-3	Difference from 10 Million Ton Rollback (Option II-2A) Option IV-1	Option IV-2	Option IV-3
Alabama, Mississippi	4,224	4,364	4,621	4,588	4,527	257	224	163
Arizona	1,944	1,943	1,990	1,990	1,985	47	47	43
Arkansas, Oklahoma, Louisiana	9,591	9,723	9,768	9,782	9,783	45	59	60
California	10,565	10,822	10,568	10,568	10,573	-254	-254	-249
Carolinas, North and South	4,759	4,895	5,245	5,202	5,190	350	307	294
Colorado	1,093	1,100	1,131	1,132	1,130	31	32	30
Dakotas, North and South	567	565	586	586	581	20	20	16
Florida	6,127	6,198	6,494	6,470	6,471	296	272	273
Georgia	2,555	2,622	2,836	2,809	2,797	213	187	174
Idaho	221	221	221	221	221	0	0	0
Illinois	4,189	4,432	4,659	4,574	4,465	227	142	33
Indiana	3,095	3,233	3,602	3,555	3,510	369	322	277
Iowa	1,230	1,327	1,410	1,421	1,414	83	94	87
Kansas, Nebraska	1,854	1,862	1,943	1,950	1,942	81	88	81
Kentucky	3,103	3,499	3,402	3,375	3,394	-97	-124	-105
Maine, Vermont, New Hampshire	1,123	1,123	1,150	1,149	1,146	27	26	23
Maryland, Delaware	1,885	1,654	2,052	2,037	1,976	398	383	322
Massachusetts, Connecticut, Rhode Island	3,513	3,678	3,717	3,707	3,695	38	29	16

(Continued)

TABLE 28. (Continued)

State	Base Case	10 Million Ton Rollback Option II-2A	Option IV-1	Option IV-2	Option IV-3	Difference from 10 Million Ton Rollback (Option II-2A) Option IV-1	Option IV-2	Option IV-3
Michigan	2,817	2,944	3,111	3,099	3,084	167	155	140
Minnesota	1,186	1,228	1,269	1,269	1,273	42	42	45
Missouri	2,024	2,206	2,355	2,363	2,314	149	157	108
Montana	676	675	685	685	687	10	10	12
Nevada	1,096	1,122	1,135	1,135	1,135	14	14	14
New Mexico	1,158	1,144	1,165	1,165	1,158	21	21	14
New York (Downstate), New Jersey	4,878	5,200	5,044	5,037	5,023	-156	-163	-177
New York (Upstate)	2,395	2,236	2,525	2,527	2,518	289	292	283
Ohio	4,239	4,271	4,847	4,790	4,695	576	518	423
Pennsylvania	5,512	6,056	6,131	6,056	5,930	75	0	-126
Tennessee	2,078	2,028	2,348	2,350	2,330	321	322	303
Texas	15,852	15,844	16,073	16,073	16,047	228	228	202
Utah	1,345	1,368	1,380	1,380	1,380	12	12	12
Virginia, District of Columbia	1,884	1,926	2,019	2,007	2,010	93	81	84
Washington, Oregon	4,219	4,068	4,258	4,258	4,252	190	190	184
West Virginia	1,784	2,278	2,397	2,344	2,309	118	66	30
Wisconsin	1,572	1,734	1,841	1,825	1,805	107	91	70
Wyoming	1,026	1,039	1,074	1,073	1,070	36	35	32
U.S. Total	117,380	120,630	125,051	124,554	123,821	4,421	3,924	3,191

SOURCE: Congressional Budget Office.

this study, emission taxes are assumed to be passed directly to the consumer as operating expenses. An important assumption to recall when interpreting these results is the fact that electricity demand remains fixed in the analysis: consumers do not respond to higher rates with cutbacks in electricity use.

Table 29 compares the average electricity rates in the states under the three tax policies with Option II-2A and the base case. The pattern of rate increases from the tax policies and scrubber subsidies resembles the distribution of costs described in the previous section, in that the largest rate increases would appear in the midwestern and Appalachian states, while western utilities would raise rates only slightly. The tax-only policy, Option IV-1, would raise average electricity rates by 2.9 mills per kilowatt hour (4.7 percent) in 1995 compared with the base case. This is nearly twice the average rate increase under Option II-2A, primarily because of the continuing tax on remaining emissions. This burden, while substantial, would fall mostly on states already predicted to enjoy lower than average 1995 base case rates. In the case of the 11.4 mill per kwh rate hike in West Virginia (a 42 percent increase from the base case), the rates would still remain among the lowest in the nation, and even fall below their predicted levels under Option II-2A. Thus, the tax policy tends to lessen--but not necessarily eliminate--the unit cost advantage enjoyed by states which have historically burned cheap local coal to generate electricity.

Predicted 1995 electricity rates for Option IV-2 and IV-3 show that subsidies for scrubbers would effectively limit rate increases in several regions. The average electricity price with a 90 percent capital subsidy would rise by 2.3 mills per kwh under Option IV-2, and only 1.8 mills per kwh with the additional 50 percent O&M subsidy of Option IV-3. Under the latter policy, several states would experience smaller rate increases than under Option II-2A, notably Illinois, Missouri, Ohio, Pennsylvania, Tennessee, and West Virginia. The subsidy for scrubbers, although not effective at this level for reducing overall emissions, does represent an effective way to ease the burden to electricity consumers in regions most adversely affected by the emission tax.

Revenues and Outlays with Emission Taxes and Subsidies

If the $600 per ton fee had been assessed on 1985 emissions--assuming that utilities could not significantly alter their fuel mix, transmission decisions, or scrubber use in the short run--tax revenues would have been nearly $9.1 billion in the first year. The stream of revenues in succeeding years would

then depend on the speed with which utilities could lower their emissions to reduce tax payments. The initial reductions under all policies would probably occur as utilities increase generation from units with lower emission rates and begin to purchase coal with less sulfur content. By 1995 annual revenues from the simple emission tax would be $4.9 billion, which represents a level of taxable emissions attained almost completely by fuel switching.

The planning and construction time of additional scrubbing units would not allow utilities to use retrofits until the early 1990s. Additional erosion of the tax base because of emission reductions attained through subsidized scrubbing would occur by 1995, which would result in annual tax revenues from Option IV-2 and Option IV-3 of $4.7 billion as of 1995. Table 30 shows the state breakdown of emission tax receipts and trust fund outlays.

Taxing only pre-NSPS sources would provide utilities with a strong incentive to retire these units sooner than they would under current policy, particularly if they choose not to install scrubbers. While an analysis of this effect lies beyond the scope of this study, this could lower revenues soon after the turn of the century. Eventually, all taxed sources would be replaced with newer plants that are subject to the federal NSPS, which are not taxed.

Annual Outlays. Annual outlays for scrubber subsidies under Option IV-2 would be $462 million by 1995. Pennsylvania and Illinois would receive 75 percent of this total ($347 million). This implies that Option IV-2 would run annual surpluses of $4.3 billion by 1995. With an additional 50 percent O&M subsidy, utilities would receive total subsidies of $1.3 billion per year by 1995, leaving Option IV-3 with annual surpluses of $3.3 billion. Under Option IV-3, Illinois and Pennsylvania utilities would receive an additional $168 million per year over Option IV-2. Together with utilities in Missouri and Ohio, they would receive $725 million annually, or over half of all subsidies given nationwide.

Other Uses for Tax Revenues. Since annual revenues from the emission tax would always exceed any scrubbing subsides granted, substantial amounts of revenues would accumulate under each tax policy. A trust fund based on Option IV-3 beginning in 1986, for example, could accumulate almost $80 billion by 1995, and reach $250 billion by 2015. Options IV-1 and IV-2 would collect even more. The potential for such large balances suggests that, if an emission tax scheme was enacted, collected funds would not be allowed to lie in a trust fund simply to collect interest, but might be diverted to other uses. Such uses might include adding to general revenues

TABLE 29. ELECTRICITY PRICES IN 1995 UNDER THREE EMISSION TAX OPTIONS COMPARED WITH A POLLUTER PAYS ROLLBACK OF 10 MILLION TONS, BY STATE (In 1985 mills per kilowatt hour)

State	Base Case	10 Million Ton Rollback Option II-2A	Option IV-1	Option IV-2	Option IV-3	Percent Difference from 10 Million Ton Rollback (Option II-2A) Option IV-1	Option IV-2	Option IV-3
Alabama, Mississippi	46.6	45.6	50.1	49.7	48.4	9.8	9.1	6.2
Arizona	55.9	55.9	57.3	57.3	57.2	2.6	2.6	2.3
Arkansas, Oklahoma, Louisiana	77.5	78.8	78.8	78.9	78.9	0.1	0.2	0.2
California	78.3	78.3	78.3	78.3	78.3	0.0	0.0	-0.1
Carolinas, North and South	50.3	51.2	54.2	53.8	53.7	5.9	5.2	5.0
Colorado	57.4	57.7	58.8	58.6	58.5	1.9	1.5	1.4
Dakotas, North and South	32.1	30.4	31.6	31.6	30.1	3.9	3.9	-1.0
Florida	75.2	75.9	78.7	78.4	78.4	3.7	3.3	3.3
Georgia	54.2	56.2	58.7	58.3	56.0	4.6	3.9	-0.2
Idaho	43.0	43.5	44.7	44.7	44.5	2.8	2.8	2.4
Illinois	59.3	62.4	64.1	62.1	61.7	2.7	-0.4	-1.0
Indiana	53.9	55.5	60.3	58.8	58.9	8.5	6.0	6.0
Iowa	59.3	62.3	65.3	65.4	65.1	4.8	5.0	4.5
Kansas, Nebraska	57.9	58.4	60.5	60.6	60.4	3.5	3.6	3.5
Kentucky	55.0	55.0	59.2	58.6	58.9	7.6	6.6	7.1
Maine, Vermont, New Hampshire	80.9	80.3	81.3	80.7	80.7	1.3	0.4	0.6
Maryland, Delaware	66.4	69.2	70.3	69.9	67.0	1.5	1.0	-3.1
Massachusetts, Connecticut, Rhode Island	80.6	84.7	84.4	83.5	83.6	-0.3	-1.4	-1.3

(Continued)

TABLE 29. (Continued)

State	Base Case	10 Million Ton Rollback Option II-2A	Option IV-1	Option IV-2	Option IV-3	Percent Difference from 10 Million Ton Rollback (Option II-2A) Option IV-1	Option IV-2	Option IV-3
Michigan	57.7	58.2	60.7	60.2	60.1	4.3	3.5	3.3
Minnesota	54.2	55.1	57.8	57.8	57.9	4.9	4.9	5.0
Missouri	59.6	63.8	67.1	66.2	63.6	5.3	3.9	-0.3
Montana	41.1	41.0	41.7	41.7	41.8	1.8	1.8	2.1
Nevada	48.8	47.0	49.9	50.0	50.0	6.0	6.2	6.3
New Mexico	68.2	67.2	69.0	64.8	64.4	2.6	-3.5	-4.1
New York (Downstate), New Jersey	99.3	100.3	101.9	100.9	100.9	1.6	0.6	0.6
New York (Upstate)	53.1	55.3	55.2	55.3	54.8	-0.2	-0.1	-0.9
Ohio	57.8	62.2	62.9	62.6	60.8	1.1	0.6	-2.3
Pennsylvania	58.2	60.0	63.7	58.4	58.8	6.1	-2.7	-2.0
Tennessee	46.9	50.7	49.5	48.2	46.8	-2.4	-4.8	-7.7
Texas	79.4	79.4	80.5	80.5	79.2	1.3	1.3	-0.3
Utah	39.0	44.7	41.2	41.2	41.2	-7.7	-7.7	-7.7
Virginia, District of Columbia	58.7	60.7	61.8	61.5	61.7	1.8	1.4	1.5
Washington, Oregon	35.4	35.4	35.2	35.2	35.3	-0.7	-0.7	-0.5
West Virginia	27.2	46.7	38.6	38.6	40.3	-17.3	-17.3	-13.6
Wisconsin	52.7	57.9	59.2	58.7	58.0	2.3	1.4	0.3
Wyoming	43.0	43.5	44.7	44.7	44.5	2.8	2.8	2.4
U.S. Average	62.0	63.5	64.9	64.3	63.8	2.2	1.2	0.4

SOURCE: Congressional Budget Office.

TABLE 30. 1995 REVENUES AND SUBSIDIES UNDER THREE EMISSION TAX OPTIONS (In millions of 1985 dollars)

State	1986 Tax Revenues [a]	Revenues			Subsidies	
		Option IV-1	Option IV-2	Option IV-3	Option IV-2	Option IV-3
Alabama, Mississippi	352	240	232	214	0	108
Arizona	60	48	48	58	0	0
Arkansas, Oklahoma, Louisiana	78	62	62	62	0	0
California	2	6	6	6	0	0
Carolinas, North and South	433	268	262	257	0	0
Colorado	39	35	35	35	0	2
Dakotas, North and South	3	20	20	15	0	10
Florida	246	241	240	240	0	0
Georgia	439	163	163	164	0	13
Idaho	0	0	0	0	0	0
Illinois	643	283	284	285	160	234
Indiana	698	261	256	255	3	62
Iowa	153	68	61	63	0	0
Kansas, Nebraska	76	66	66	65	0	0
Kentucky	400	197	170	175	1	1
Maine, Vermont, New Hampshire	65	23	21	21	3	5
Maryland, Delaware	169	116	116	116	0	91
Massachusetts, Connecticut, Rhode Island	177	184	184	184	14	21

(Continued)