TABLE 30. (Continued)

State	1986 Tax Revenues [a]	Revenues			Subsidies	
		Option IV-1	Option IV-2	Option IV-3	Option IV-2	Option IV-3
Michigan	313	205	197	197	1	4
Minnesota	105	71	63	62	0	0
Missouri	668	132	140	156	20	112
Montana	12	10	10	10	0	0
Nevada	31	23	24	24	0	0
New Mexico	22	21	21	21	0	0
New York (Downstate), New Jersey	161	150	152	152	23	35
New York (Upstate)	189	102	105	105	0	18
Ohio	1,141	437	414	415	9	98
Pennsylvania	807	455	344	343	187	281
Tennessee	406	202	199	199	14	86
Texas	186	195	195	171	0	71
Utah	19	20	19	19	0	0
Virginia, District of Columbia	58	98	98	99	0	0
Washington, Oregon	22	37	37	37	0	3
West Virginia	581	255	255	261	27	56
Wisconsin	345	142	142	141	0	33
Wyoming	31	37	37	36	0	0
U.S. Total	9,129	4,873	4,679	4,665	462	1,343

SOURCE: Congressional Budget Office.

a. Calculated by using 1985 emissions and $600 per ton SO_2 tax.

to reduce deficits, reducing other taxes, or eventually returning the money to the states based on their contributions.

To the extent that the economy benefits from emission reductions, emission taxes can represent an economically efficient method of collecting general revenues--a crucial concern in this era of high budget deficits.[9] Economists typically voice concern about the potential distortions caused by current methods of taxing economic activity; taxes levied on income earned from labor or investment may reduce the incentive to work or save. Individuals or corporations respond to taxation by avoiding or reducing economic activity that is taxed. Under an emission tax policy, these same incentives would promote a valuable response--the reduction of pollution. Collected tax revenues could be used to offset other, less beneficial taxes, while tax revenues lost through successful abatement efforts would represent a benefit to society if the tax rate approximates to some degree the level of damage caused by additional emissions.

Alternatively, a rebate scheme could be devised, through which states would receive revenues based on their net contributions. These revenues could be used to reduce other state taxes, or they could be redistributed to those electricity consumers who had suffered the highest rate increases. This would reduce the burden on the midwestern and Appalachian states, but still encourage emission reductions. The states could also target some of these revenues for relief programs for unemployed miners. Finally, to ease the initial burden to utilities and consumers, the Congress might consider phasing in the tax or delaying its commencement for several years. In the early years of an emission tax (that is, 1986-1990 in this analysis), utilities would only gradually reduce emissions. The speed of emission reductions might not be greatly affected by taxing emissions at less than the full rate initially. The threat of a future emission tax at a punitive (reduction-forcing) level must remain credible, however, for utilities to develop abatement plans in the interim.

COAL MARKETS AND MINING EMPLOYMENT

Emission tax policies would affect the distribution of coal production and employment. Regions that produce primarily high-sulfur coal would face lower coal production and employment under an emission tax policy to con-

9. For a discussion and estimates of the benefits of substituting effluent tax revenues for some corporate and personal income tax revenues, see David Terkla, "The Efficiency Value of Effluent Tax Revenues," *Journal of Environmental Economics and Management*, vol. 11, no. 2 (June 1984).

trol acid rain than they would if current policy was continued. Subsidies for scrubbers could only partially mitigate this effect. Tables 31 and 32 compare 1995 coal production and employment under the three tax policies with base case projections and Option II-2A.

Coal-Market Shifts Without Subsidies. The imposition of a simple emission tax without subsidies (Option IV-1) would shift coal production from the midwestern high-sulfur coal mines to eastern low-sulfur coal sources (large-

TABLE 31. 1995 COAL SHIPMENTS UNDER THREE EMISSION TAX OPTIONS COMPARED WITH A POLLUTER PAYS ROLLBACK OF 10 MILLION TONS, BY STATE (In millions of tons)

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	23.8	22.1	26.9	23.5	23.8	4.8	1.4	1.7
Arizona	14.2	13.9	13.9	13.9	13.8	0.0	0.0	-0.2
Colorado	19.1	23.5	21.9	21.6	20.8	-1.7	-2.0	-2.7
Illinois	56.4	37.6	39.5	47.4	51.0	2.0	9.8	13.4
Indiana	29.2	19.7	23.8	24.5	28.2	4.1	4.8	8.4
Iowa	1.5	0.5	0.5	0.5	1.3	0.0	0.0	0.8
Kansas	2.5	0.4	0.4	1.4	1.4	0.0	1.0	1.0
Kentucky	208.9	195.9	202.5	198.6	197.7	6.5	2.6	1.8
Maryland	2.5	1.5	1.5	1.8	2.2	0.0	0.3	0.7
Missouri	8.1	5.3	5.3	6.5	7.1	0.0	1.2	1.8
Montana	34.0	26.0	26.8	31.1	32.4	0.9	5.1	6.4
New Mexico	31.9	31.9	31.9	31.9	31.7	0.0	0.0	-0.1
North Dakota	22.7	22.7	22.7	22.7	22.7	0.0	0.0	0.0
Ohio	24.3	4.0	4.0	7.9	16.1	0.0	3.9	12.1
Oklahoma	7.7	7.0	7.2	7.2	7.7	0.1	0.1	0.7
Pennsylvania	82.3	56.3	63.9	68.8	69.7	7.6	12.5	13.3
Tennessee	5.3	4.9	6.9	4.9	6.8	2.0	0.0	1.8
Texas	109.4	108.8	108.6	108.6	110.1	-0.2	-0.2	1.3
Utah	31.6	32.8	31.1	31.1	31.2	-1.7	-1.7	-1.6
Virginia	50.6	56.0	59.4	55.4	56.9	3.5	-0.5	0.9
Washington	0.5	0.5	0.5	0.5	0.5	0.0	0.0	0.0
West Virginia	232.2	274.6	276.1	269.9	254.9	1.5	-4.7	-19.6
Wyoming	130.5	191.2	156.5	154.2	147.3	-34.7	-36.9	-43.9
U.S. Total	1,128.9	1,137.1	1,131.7	1,133.7	1,135.2	-5.4	-3.4	-1.9

SOURCE: Congressional Budget Office.

TABLE 32. DIRECT COAL MINING EMPLOYMENT IN 1995 UNDER THREE EMISSION TAX OPTIONS COMPARED WITH A POLLUTER PAYS ROLLBACK OF 10 MILLION TONS, BY STATE (In miner-years)

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	8,124	7,543	9,182	8,018	8,128	1,640	476	585
Arizona	1,177	1,155	1,155	1,155	1,141	0	0	-13
Colorado	3,288	4,062	3,773	3,725	3,590	-289	-337	-472
Illinois	14,733	9,823	10,333	12,392	13,325	510	2,569	3,502
Indiana	5,342	3,611	4,355	4,487	5,149	744	876	1,538
Iowa	344	110	110	110	305	0	0	195
Kansas	753	129	129	441	441	0	311	311
Kentucky	63,014	59,098	61,061	59,894	59,641	1,964	796	543
Maryland	695	417	417	504	616	0	86	199
Missouri	1,948	1,276	1,277	1,554	1,705	1	277	429
Montana	1,251	955	987	1,142	1,192	32	187	237
New Mexico	2,846	2,846	2,846	2,846	2,835	0	0	-11
North Dakota	1,375	1,374	1,374	1,374	1,375	0	0	1
Ohio	7,136	1,183	1,183	2,321	4,740	0	1,138	3,557
Oklahoma	2,344	2,146	2,190	2,190	2,347	44	44	200
Pennsylvania	29,299	20,042	22,749	24,482	24,789	2,707	4,411	4,747
Tennessee	2,010	1,859	2,614	1,859	2,550	755	-1	691
Texas	6,890	6,854	6,841	6,841	6,939	-13	-13	84
Utah	7,978	8,282	7,852	7,852	7,882	-430	-430	-399
Virginia	19,399	21,375	22,695	21,168	21,714	1,321	-207	-339
Washington	48	48	48	48	48	0	0	0
West Virginia	89,473	105,792	106,371	103,982	98,222	579	-1,810	-7,570
Wyoming	5,768	8,451	6,917	6,818	6,511	-1,534	-1,633	-1,940
U.S. Total	275,172	268,431	276,461	275,202	275,183	8,030	6,771	6,752

SOURCE: Congressional Budget Office.

ly in West Virginia) and, to a less extent, to western low-sulfur coal mines (mostly in Wyoming). Predicted 1995 coal production in Illinois, Indiana, Ohio, and Pennsylvania could decline by 61 million tons compared with expectations under current policy. Such a production shift would reduce projected mining employment in this region by nearly 18,000 jobs in 1995, or nearly 17,300 jobs less than current levels. 10/ This shift would still be

10. See Table 12 in Chapter II for 1985 employment figures.

about 14 million tons (representing 4,000 jobs) less than the regional decline expected under Option II-2A, although its magnitude could still warrant concern. Since the emission tax would generate nearly $4.9 billion annually by 1995, however, any funding devoted explicitly to employment assistance would still comprise only a small fraction of the annual surplus.

Coal Markets with Scrubber Subsidies. Subsidies for scrubbers would retard, but not eliminate, the shift away from high-sulfur coal mined in Illinois, Indiana, Ohio, and Pennsylvania. Compared with predicted employment for Options II-2A, II-2B, and II-2C, the subsidies combined with an emission tax would provide greater production and employment in these four states. 11/ Compared with Option IV-1, Option IV-2 would increase 1995 production in the region by over 17 million tons, and help preserve almost 5,100 mining jobs. The addition of the 50 percent O&M subsidy would basically double these benefits, as 1995 production would be nearly 34 million tons higher than under Option IV-1. This additional production would require nearly 9,400 miners more than Option IV-1.

Even with scrubber subsidies, some states would lose mining employment compared with 1985 levels. Under the most heavily subsidized policy, Option IV-3, the four states that lose the most compared with 1985 employment--Alabama, Illinois, Indiana, and Ohio--would lose only 10,500 jobs. After taking into account likely productivity gains and normal attrition, an assistance program aimed at currently employed miners could be relatively inexpensive, especially when compared with annual surpluses from the emission tax.

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11. Options IV-2 and IV-3, however, would yield slightly higher 1995 emissions (9.6 million tons) than the 10 million ton rollback options (9.2 million tons).

CHAPTER V

LOWERING SULFUR DIOXIDE LEVELS WITH TAX ON SULFUR CONTENT IN COAL AND SUBSIDIES FOR SCRUBBING

The direct emission tax discussed in Chapter IV represents one example of using economic incentives to control pollution. This chapter examines a related approach in which regulators would impose a sales tax on coal based on its sulfur content, and grant subsidies for utilities that remove sulfur dioxide from the flue gas with scrubbers. Two policies are considered, differing only in the basis for the tax. In the first option, the tax rate would be determined by the sulfur content **per ton**, while in the second case, the tax per ton would be calculated using the sulfur content **per British thermal unit**, a measure of energy content. Because of the variations in both energy and sulfur contents of U.S. coals, tax rates that elicit similar emission reductions could lead to different program costs, electricity rates, coal-market patterns, and net tax revenues.

The first policy would place a $0.50 tax on each pound of sulfur contained in a ton of coal (for sulfur content in excess of 10 pounds per ton), and would provide both a 90 percent capital subsidy for retrofit scrubbers and a $0.50 subsidy for each pound of sulfur removed from the flue gas. Representative Aspin introduced this proposal in the 98th Congress as H.R. 4483, and it is referred to here as Option V-1. The second policy, Option V-2, would grant identical scrubber subsidies, but would levy a tax per ton equal to $10 for every pound of sulfur per million Btus (for sulfur content in excess of 0.4 pounds per million Btus).

Both policies would lower sulfur dioxide emissions in 1995 to about 10.3 million tons from the projected level of 18.5 million tons under current policy. The program cost of Option V-1 over the 1986 through 2015 period would total $32.1 billion, and would cost $289 for each ton of SO_2 reduced by 1995. The corresponding costs of Option V-2 would be $37.4 billion over the period, or $339 per ton of SO_2 abated. (All dollar amounts are in discounted 1985 dollars.) Both policies appear to be relatively cost-effective, considering their level of emission reductions and their high degree of retrofit scrubber use.

Using the Option V-1 formula, the average tax rate in 1995 would be $7.00 per ton of coal. Assessing the tax on sulfur content per ton favors the

low-sulfur, low-heat content of western coals over high-sulfur coals having high-heat content, such as those found in the Midwest and parts of the East. Coal production in Illinois, Indiana, Kentucky, Ohio, and Pennsylvania would be 62 million tons lower in 1995 than projected annual levels, which would also lower predicted mining employment in these states by 18,400 jobs. (Kentucky is included in this group because of its sensitivity to the various sulfur-tax options.)

The sales tax based on sulfur content per Btu (Option V-2) would alter these results. The average tax collected per ton in 1995 would be $7.48; it is higher than the average under Option V-1 chiefly because a higher rate would be levied on western low-sulfur coal and Texas lignite. The 1995 production shortfall in the five states listed above would be limited to 42.8 million tons, and associated employment would be only 12,600 jobs less than projected under base case conditions.

TAXING THE SULFUR CONTENT OF FUEL: THEORY AND IMPLEMENTATION

Several countries have imposed taxes on material inputs used by industries in processes that produce pollution. Examples include sulfur taxes on oil in Norway and on sulfur in all fossil fuels in the Netherlands, and taxes on chemical feedstocks that constitute the basis for the hazardous waste clean-up effort under "Superfund" in the United States.[1] While these charges are levied primarily to generate revenues, taxing the constituents of pollution can force input substitutions or output reductions that lower the ultimate level of emissions.

Input taxes designed to reduce emissions are a feasible alternative to direct effluent charges in many cases. When emissions are difficult to detect, monitor, or measure and arise from many distinct sources, then emission fees could become prohibitively costly to assess and collect. This is not the case with coal-fired power plants, however. Yet, if a fairly direct link exists between one (or at most a few) materials and the generation of pollution, and if firms can purchase other substitute resources that will produce less pollution when used, then input taxes still may be effective regulatory instruments. Coal-fired power plants certainly meet these latter criteria. Moreover, because the government can collect an input tax at the point of an existing market transaction--the sale of coal--few additional resources would be required for enforcement.

1. See *Pollution Charges in Practice* (Paris: Organization for Economic Cooperation and Development, 1980) for a description of European experiences with sulfur taxes; and Congressional Budget Office, *Hazardous Waste Management: Recent Changes and Policy Alternatives* (May 1985) for an examination of Superfund.

Neither of the proposals studied in this chapter are pure input tax programs, since they include subsidies for scrubber use. Because coal purchases are routinely assayed for chemical content, setting a tax on sulfur content would be relatively easy. The amount of sulfur scrubbed out of the flue gas would have to be measured or estimated fairly accurately, however, in order to provide the subsidy for emission reduction. Administrators could develop standard formulas to estimate the amount of sulfur removal in plants that use scrubbers. Out of 1,300 coal-fired boilers operating as of December 1984, 125 were equipped with scrubbers (92 new, 33 retrofit). 2/ For all other plants, regulators would need only the data contained on fuel receipts, until more scrubbers were retrofitted on existing plants under the scrubber installation subsidy.

These proposals that combine a sulfur tax with a subsidy for sulfur removal resemble deposit and refund systems. When utilities purchase coal subject to the sulfur tax, they pay a fee for the potential sulfur dioxide that might be discharged. For example, a high-emitting midwestern plant could pay about $30 million per year in higher coal prices under Option V-1 and roughly $25 million per year with Option V-2. 3/ Utilities that simply emit SO_2 into the atmosphere would forgo this deposit, while power plants that scrub out most of the sulfur before emitting it as SO_2 would receive a refund. Such a system would provide a strong incentive to reduce emissions either by fuel switching or by scrubbing. In contrast, a sulfur tax alone would only encourage fuel switching, since scrubbing is most economical when the price of high-sulfur coal remains low relative to low-sulfur coal--precisely the opposite situation expected under a tax on sulfur content.

THE EFFECTS OF SULFUR TAXES AND SUBSIDIES

The two sulfur tax policies considered in this chapter are shown in Table 33. The taxes levied on coal would begin in 1986 (based on 1985 coal usage) and are assumed to be permanent. The subsidy for sulfur removed with existing scrubbers also would begin in 1986. Capital subsidies for scrubber retrofits would not be required until 1991, because of the planning and construction time required for retrofit scrubbers, and all additional retrofits are assumed

2. Figures are from Department of Energy, Energy Information Administration, *Inventory of Power Plants in the United States* and *Cost and Quality of Fuels for Electric Utility Plants* (both July 1985).

3. This analysis is based on operation of a 500 megawatt plant used for baseload generation (65 percent capacity factor at 10,000 Btu per kwh generated) using a bituminous coal (12,000 Btu per lb.) that emits 5 pounds of SO_2 per million Btu.

TABLE 33. SULFUR AND SUBSIDY OPTIONS

Policy Option	Tax Rate and Exemption	Subsidies
Option V-1 (H.R. 4483)	$0.50 per pound of sulfur contained in each ton of coal, to the extent that sulfur content exceeds 10 pounds per ton.	$0.50 subsidy granted for each pound of sulfur scrubbed out of flue gas, plus a 90 percent capital subsidy for retrofitted scrubbers.
Option V-2	$10 per pound of sulfur contained in a million Btus, to the extent that sulfur content exceeds 0.4 pounds per million Btus. When multiplied by the heat content of the coal (in millions of Btus per ton), this figure gives the tax rate per ton.	$0.50 subsidy granted for each pound of sulfur scrubbed out of flue gas, plus a 90 percent capital subsidy for retrofitted scrubbers.

SOURCE: Congressional Budget Office.

to be completed by 1995. These subsidies are computed as 90 percent of annual capital costs, and continue for the entire financial life (20 years) of the scrubber.

Because the sulfur tax would be levied on all coal sales, some of the cost, revenue, and coal-market effects would depend on nonutility coal purchases (by domestic metallurgical, industrial, and commercial users plus exports). [4] Currently, nonutility demand accounts for about one-quarter of all coal mined in the United States. In this analysis, the demand for coal is assumed to remain stable regardless of price changes. Even though coal used by nonutilities tends to be low in sulfur content, some of the costs of this program would be shifted to other coal purchasers.

Emissions Under Sulfur Tax and Subsidy Policies

The geographic distribution of emission reductions is quite similar in both options, and remains consistent with the distribution predicted under other

4. In H.R. 4483, export coal (which currently accounts for less than 10 percent of total coal mined in the U.S.) was exempted from the tax. In the National Coal Model, however, this was not possible. Even if the tax were applied to exports, it would not raise their prices significantly, because of the low-sulfur content of export coal.

proposals. The vast majority of SO_2 reductions would occur in the midwestern and Appalachian states, while modest emission growth in the West would remain unaffected. Table 34 displays utility SO_2 emissions in 1995 under each policy, and provides comparisons with the basic 8 million ton and 10 million ton polluter pays reductions reported in Chapter II. The 10.3 million tons of SO_2 expected under each of the sulfur tax policies is equivalent to an 8.9 million ton reduction, as measured from 1980 emission levels from old sources.

Emissions in 1995 from most of the midwestern and Appalachian states would be between those expected under the 8 million ton and 10 million ton rollbacks as specified by the excess emissions formula. Compared with that allocation formula, the two tax policies would limit emissions slightly more in Missouri, Indiana, and Pennsylvania (all of which would yield emission levels close to the 10 million ton reduction program), while exerting less influence on emissions from Illinois (where 1995 emissions would be closer to those predicted under the 8 million ton reduction).

State by state comparisons show only small emission differences between the two sulfur tax policies. This similarity, however, hides the important difference that scrubber utilization would be higher under Option V-2 than under Option V-1. Utilities in Missouri, Ohio, and West Virginia would retrofit over twice as much existing capacity with scrubbers under Option V-2, installing $3.4 billion worth of equipment. While much more local high-sulfur coal would be burned, emissions in these three states would be only 0.12 million tons higher under Option V-2 than under Option V-1.

In states west of the Mississippi (not including Minnesota, Iowa, and Missouri), emissions would continue to rise slightly from current levels under each policy. As discussed in earlier chapters, plants in the West already employ strict control measures, and further reductions would not be economical under either tax program.

The Cost of Sulfur Tax and Subsidy Programs

As discussed in Chapter IV, comparing the costs of tax incentive policies with the costs of policies that use a compliance deadline requires care, since the timing of costs incurred, as well as emission reductions obtained, may differ among approaches. In particular, incentive schemes would probably encourage utilities to incur abatement costs earlier and reduce emissions sooner than would a rollback policy based on a 10-year compliance deadline. Under these circumstances, the cost-effectiveness numbers yield more fruitful comparisons than the discounted program cost figures.

TABLE 34. EMISSIONS UNDER TWO SULFUR TAX OPTIONS COMPARED WITH TWO POLLUTER PAYS ROLLBACK PROGRAMS, BY STATE
(In thousands of tons of SO_2 emitted in 1995)

State	Base Case	8 Million Ton Rollback Option II-1A	10 Million Ton Rollback Option II-2A	Option V-1	Option V-2
Alabama, Mississippi	704	489	414	469	468
Arizona	122	117	106	118	122
Arkansas, Oklahoma, Louisiana	336	304	302	322	315
California	25	25	25	25	25
Carolinas, North and South	1,063	606	577	564	563
Colorado	92	94	94	90	97
Dakotas, North and South	105	105	105	103	99
Florida	772	605	566	605	584
Georgia	635	407	352	404	380
Idaho	0	0	0	0	0
Illinois	1,142	566	408	570	518
Indiana	1,433	799	553	617	598
Iowa	326	192	167	159	177
Kansas, Nebraska	174	167	163	153	156
Kentucky	796	512	466	463	496
Maine, Vermont, New Hampshire	64	56	44	36	35
Maryland, Delaware	371	215	189	224	224
Massachusetts, Connecticut, Rhode Island	305	241	219	306	306

(Continued)

TABLE 34. (Continued)

State	Base Case	8 Million Ton Rollback Option II-1A	10 Million Ton Rollback Option II-2A	Option V-1	Option V-2
Michigan	598	423	374	355	367
Minnesota	230	159	146	129	132
Missouri	1,257	482	293	309	329
Montana	71	68	68	68	68
Nevada	90	80	80	74	82
New Mexico	62	62	62	62	62
New York (Downstate), New Jersey	270	247	245	260	260
New York (Upstate)	343	193	141	214	219
Ohio	2,017	963	629	772	837
Pennsylvania	1,439	839	578	602	592
Tennessee	761	421	281	356	367
Texas	586	569	567	586	575
Utah	87	61	61	73	86
Virginia, District of Columbia	213	180	175	220	199
Washington, Oregon	111	108	104	104	99
West Virginia	1,042	511	421	487	504
Wisconsin	746	272	199	288	298
Wyoming	69	70	70	70	66
U.S. Total	18,455	11,208	9,241	10,256	10,305

SOURCE: Congressional Budget Office.

In terms of discounted program costs, Option V-1 would cost $32.1 billion, while the same figure for Option V-2 would be $37.4 billion (see Table 35). Compared with the 10 million ton polluter pays program (Option II-2A) at $34.5 billion, these numbers seem high, given the ultimate emission reductions obtained. When the earlier reductions expected under the tax policies are taken into account by using the measure of cost-effectiveness developed in previous chapters, however, these policies appear much better: Option V-1 would cost $289 per ton of SO_2 reduced while Option V-2 would cost $339 per ton abated. This compares favorably with Option II-2A, at $360 per ton of SO_2 abated, but less so with the 8 million ton polluter pays program (Option II-1A), costing $270 per ton abated. 5/

Comparing these cost-effectiveness figures with the generation tax and subsidy options presented in Chapter III shows that the sulfur tax and subsidy policies of this chapter represent a relatively efficient way to encourage emission reductions while promoting scrubber use. The most heavily subsidized 8 million ton reduction using a generation tax (Option III-1B) would cost $389 per ton of SO_2 removed, prompting scrubber use similar to Options V-1 and V-2, while allowing nearly one million tons of additional annual SO_2 emissions. A similarly subsidized 10 million ton reduction with a generation tax (Option III-2B) would cost as much as $431 per ton of SO_2 abated.

Cost Burden to Other Industries of a Sulfur Tax. Not included in the estimates of program costs is the burden of a sulfur tax on coal-using industries other than utilities. Demand for coal from other sectors--industrial, commercial, metallurgical, and export--is represented in the National Coal Model as predetermined regional energy requirements, and is assumed to remain constant regardless of price increases. Given this assumption, nonutility coal expenditures in 1995 would rise by $1.82 billion under Option V-1 and by $1.65 billion under Option V-2. About half of this additional expense would be accounted for by tax revenues collected in 1995 on these purchases--$910 million under Option V-1, and $850 million under Option V-2. The remainder of the additional expenditures would arise from higher prices for low-sulfur coal resulting from the increased utility demand.

These expenditures represent an extremely high estimate of costs that would be shifted to the nonutility sector, since nonutility users would substitute cheaper fuels when economical and feasible. 6/ The Congress could, of

5. See the glossary at the end of this report for definitions of all options.

6. Compared with the base case calculations of nonutility coal purchases in 1995, policies examined earlier in this report would raise expenditures in the nonutility sector by between $200 million and $550 million. Because the actual response of nonutility coal users is impossible to estimate with the National Coal Model, and because the additional costs are likely to be smaller than their expenditures suggest, these figures also were not included as program costs in earlier options.

course, choose to exempt nonutility coal purchases, thus reducing the tax burden to other coal users. Some additional costs would remain, however, as the overall demand for low-sulfur coal--and thus its price--would rise in response to the tax policy.

The Effect on Annual Utility Costs. Electric utilities nationwide would pay an additional $2.7 billion annually by 1995 if the Option V-1 tax were levied on coal purchases, and slightly more--$2.9 billion--if the Option V-2 formula were used instead. Despite the similarity in overall net utility costs, however, the two tax programs exhibit important regional differences.

As Table 36 shows, utilities in every state east of the Mississippi would incur less cost under Option V-2 than under Option V-1, while the utilities west of the river (especially Texas) would pay more. In the key states of Illinois, Indiana, Kentucky, Ohio, Pennsylvania, Tennessee, and West Virginia, utilities would spend a total of $1.7 billion more in 1995 with Op-

TABLE 35. TOTAL PROGRAM COSTS AND COST-EFFECTIVENESS OF TWO SULFUR TAX OPTIONS COMPARED WITH TWO POLLUTER PAYS ROLLBACK PROGRAMS

	Polluter Pays Rollbacks			
	8 Million Ton Rollback Option II-1A	10 Million Ton Rollback Option II-2A	Sulfur Tax Proposals Option V-1	Option V-2
Total Program Costs (In billions of discounted 1985 dollars) [a]	20.1	34.5	32.1	37.4
Cost-effectiveness (In discounted 1985 dollars per ton of SO_2 reduced) [b]	270	360	289	339

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 reductions from current policy measured over the 1986-2015 period.

TABLE 36. ANNUAL COST OF ELECTRICITY GENERATION IN 1995 UNDER SULFUR TAX OPTIONS COMPARED WITH TWO POLLUTER PAYS ROLLBACK PROGRAMS, BY STATE (In millions of 1985 dollars)

State	Base Case	Polluter Pays Options: 8 Million Ton Rollback Option II-1A	Polluter Pays Options: 10 Million Ton Rollback Option II-2A	Sulfur Tax Options: Option V-1	Sulfur Tax Options: Option V-2
Alabama, Mississippi	4,224	4,307	4,364	4,402	4,370
Arizona	1,944	1,930	1,943	1,921	1,932
Arkansas, Oklahoma, Louisiana	9,591	9,698	9,723	9,615	9,615
California	10,565	10,722	10,822	10,527	10,541
Carolinas, North and South	4,759	4,886	4,895	5,009	4,972
Colorado	1,093	1,097	1,100	1,033	1,085
Dakotas, North and South	567	565	565	580	604
Florida	6,127	6,202	6,198	6,297	6,239
Georgia	2,555	2,618	2,622	2,697	2,670
Idaho	221	221	221	221	221
Illinois	4,189	4,312	4,432	4,356	4,343
Indiana	3,095	3,202	3,233	3,368	3,332
Iowa	1,230	1,288	1,327	1,252	1,282
Kansas, Nebraska	1,854	1,860	1,862	1,884	1,882
Kentucky	3,103	3,170	3,499	3,250	3,213
Maine, Vermont, New Hampshire	1,123	1,119	1,123	1,130	1,128
Maryland, Delaware	1,885	1,853	1,654	1,931	1,915
Massachusetts, Connecticut, Rhode Island	3,513	3,633	3,678	3,532	3,523

(Continued)

TABLE 36. (Continued)

State	Base Case	Polluter Pays Options: 8 Million Ton Rollback Option II-1A	Polluter Pays Options: 10 Million Ton Rollback Option II-2A	Sulfur Tax Options: Option V-1	Sulfur Tax Options: Option V-2
Michigan	2,817	2,874	2,944	2,966	2,943
Minnesota	1,186	1,184	1,228	1,193	1,214
Missouri	2,024	2,137	2,206	2,220	2,228
Montana	676	675	675	671	674
Nevada	1,096	1,122	1,122	1,115	1,109
New Mexico	1,158	1,138	1,144	1,153	1,110
New York (Downstate), New Jersey	4,878	4,902	5,200	4,893	4,884
New York (Upstate)	2,395	2,443	2,236	2,449	2,434
Ohio	4,239	4,397	4,271	4,628	4,567
Pennsylvania	5,512	5,711	6,056	5,774	5,712
Tennessee	2,078	2,118	2,028	2,262	2,260
Texas	15,852	15,834	15,844	15,563	16,100
Utah	1,345	1,367	1,368	1,342	1,331
Virginia, District of Columbia	1,884	1,923	1,926	1,938	1,924
Washington, Oregon	4,219	4,147	4,068	4,213	4,236
West Virginia	1,784	1,936	2,278	2,035	1,994
Wisconsin	1,572	1,671	1,734	1,728	1,713
Wyoming	1,026	1,034	1,039	967	997
U.S. Total	117,380	119,298	120,630	120,115	120,296

SOURCE: Congressional Budget Office.

tion V-1, but only $1.4 billion more with Option V-2. This difference stems partly from greater use of scrubber subsidies in the latter case (primarily in Ohio and West Virginia), but also from the lower tax rate applied to the high-sulfur, high-energy content coal mined and mostly burned in the midwestern and Appalachian states.

Three states bordering the Mississippi River on the west--Minnesota, Iowa, and Missouri--could experience higher costs under Option V-2 than under Option V-1. The higher tax rate on Wyoming and North Dakota low-sulfur coal explains higher costs under Option V-2 in Iowa and Minnesota. Utilities in Missouri would install more scrubber capacity in order to burn high-sulfur coal from the Midwest (which has high-energy content) under Option V-2 than under Option V-1. While this would raise costs, it would, nevertheless, remain cheaper than burning low-sulfur, low-energy content western coal subjected to Option V-2 tax rates.

In several states west of the Mississippi, utility costs would actually decrease under both tax programs; in most of these cases, Option V-1 would lower costs more than Option V-2. This would occur because the tax rates applied to western coal would be very low (at times zero), while the $0.50 reward for each pound of sulfur removed by scrubbing would still be granted. A special case is Texas, described below.

Utility Costs in Texas and Tax Rates on Lignite Coal. The most dramatic difference in utility costs between Option V-1 and Option V-2 would occur in Texas, because of the predominance of lignite coal mined and burned there. Texas lignite coal is a medium-sulfur coal (emitting an average of 3 pounds of SO_2 per million Btus burned) of exceptionally low-energy content. The 1995 tax per ton under Option V-1 would average $5.17, while those rates would more than double--to an average of $10.74--if Option V-2 rates were levied instead.

Under Option V-1, the annual cost of generating electricity in Texas in 1995 would decrease by about $290 million dollars compared with current policy. Although $572 million in tax revenues would be collected in 1995 on lignite coal burned by Texas utilities, it would be more than offset by the $821 million granted in payments for sulfur removal in plants that employ scrubbers. In contrast, the imposition of the tax embodied in Option V-2 would raise revenues from Texas lignite mined and burned in Texas to $990 million per year in 1995, while increasing subsidy levels only to about $900 million. After taking into account additional bituminous coal shipments from other states, as well as the cost of scrubbers required to burn this coal in new plants, utilities in Texas would spend about $250 million more in 1995 under Option V-2 than predicted under the base case.

Electricity Rates Under a Sulfur Tax and Subsidy Program

Average electricity rates nationwide would be about 1 mill per kilowatt hour higher in 1995 (1.6 percent) under both of the sulfur tax policies examined in this chapter. Thus, the policies would raise 1995 electricity rates slightly higher than the 0.8 mill per kilowatt hour rise expected under Option II-1A, but would remain less than the 1.5 mill per kwh hike predicted with Option II-2A. The regional price changes, however, display substantial variation, as shown in Table 37.

Most of the rate increases in the midwest (east of the Mississippi) and Appalachian states lie in the 3 percent to 6 percent range under both options. In every case, 1995 rates in these regions would rise less under Option V-2 than under Option V-1, which is consistent with the utility cost results described in the previous section. 7/ The difference between prices charged under Option V-1 and those under Option V-2 in the East and Midwest would be about 0.5 mills per kwh in most cases. In contrast, 1995 rates in Missouri would rise by 5.4 mills per kwh (9.1 percent) in the Option V-1 case, and by 7.6 mills per kwh (12.8 percent) with Option V-2. These represent the largest increases expected under either policy.

With either option, a few western states would experience modest electricity rate increases, while others could expect significant decreases. States in which predicted 1995 electricity prices under the tax policies would be lower than base case projections tend to be those which burn primarily low-sulfur coal in NSPS plants with scrubbers. Since these plants would receive subsidies for sulfur removal that would have occurred anyway, rates would be lower, assuming that state commissions would pass the cost savings through to consumers.

Government Revenues and Outlays with Sulfur Taxes and Subsidies

Revenues and Outlays in 1986. Both tax policies would generate enough revenues to cover all subsidy obligations. Table 38 shows the tax rates and

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7. One striking exception to the pattern of moderate rate increase would occur in West Virginia, where generation costs would rise between 12 percent and 14 percent under the sulfur tax policies (see Table 36), but where electricity rates are projected to decline by about 30 percent. This spurious result arose from the way the algorithm used accounts for interregional sales, which are priced at the avoided cost of the importing region. Since utilities in West Virginia produce power very cheaply with local coal, and are projected to export over half of their generation in 1995 to adjacent states, the revenues collected from out-of-state sales would rise more than generation costs rise--thus reducing dramatically the price charged to West Virginia consumers. In reality, state commissions would probably set the interregional price somewhere in between the generation cost and the avoided cost, thereby limiting this rate reduction.

TABLE 37. 1995 ELECTRICITY PRICES UNDER SULFUR TAX POLICIES COMPARED WITH TWO POLLUTER PAYS ROLLBACK PROGRAMS, BY STATE (In 1985 mills per kilowatt hour)

State	Base Case	Polluter Pays Options: 8 Million Ton Rollback Option II-1A	Polluter Pays Options: 10 Million Ton Rollback Option II-2A	Sulfur Tax Options: Option V-1	Sulfur Tax Options: Option V-2
Alabama, Mississippi	46.6	46.9	45.6	48.2	47.9
Arizona	55.9	55.5	55.9	55.4	55.7
Arkansas, Oklahoma, Louisiana	77.5	78.5	78.8	77.8	77.8
California	78.3	78.3	78.3	78.1	78.2
Carolinas, North and South	50.3	51.2	51.2	52.3	52.0
Colorado	57.4	57.6	57.7	56.7	56.9
Dakotas, North and South	32.1	31.4	30.4	32.3	33.3
Florida	75.2	76.0	75.9	76.9	76.5
Georgia	54.2	56.1	56.2	56.7	54.9
Idaho	43.0	43.3	43.5	40.9	42.0
Illinois	59.3	60.8	62.4	61.8	61.0
Indiana	53.9	55.0	55.5	57.0	56.4
Iowa	59.3	61.1	62.3	60.8	61.5
Kansas, Nebraska	57.9	58.1	58.4	58.0	58.4
Kentucky	55.0	55.9	55.0	57.1	56.6
Maine, Vermont, New Hampshire	80.9	80.4	80.3	80.9	80.8
Maryland, Delaware	66.4	67.6	69.2	68.1	67.6
Massachusetts, Connecticut, Rhode Island	80.6	83.0	84.7	81.0	80.8

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