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CHAPTER 2

DISTRIBUTION OF ALLOWANCES

As discussed, Title IV of the CAAA sets as its primary goal the reduction of annual SO_2 emissions by 10 million tons below 1980 levels by 2000. To achieve these SO_2 reductions, the law requires a two-phase approach involving the trading of annual SO_2 allowances that gradually tightens the restrictions placed on fossil fuel-fired power plants.

Phase I begins in 1995 and affects 110 mostly coal-burning electric utility plants located in twenty-one eastern and midwestern states. The number of phase I units by state, the affected capacity, and the percent of total state capacity are shown in Table 2-1. In the context of the CAAA, a unit is defined as a fossil fuel-fired combustion device. The total SO_2 (from all sources), allocated allowances, and the required reduction are listed in Table 2-2. Figure 2-1 maps the percent of the total SO_2 reduction required for each state. As the tables and figure indicate, the impact is concentrated in the eastern half of the continental United States. Four states, Illinois, Indiana, Missouri, and Ohio, each have over 10 percent of the total SO_2 reductions and together account for over 60 percent of the total required reduction. In Ohio, Indiana, and West Virginia almost 50 percent of each state's total capacity is affected. Again, however, it should be noted that while most of the reduction is located in the eastern half of the United States, in order to add fossil capacity in any state, additional allowances will have to be acquired from their holders.

Phase II, which begins in the year 2000, tightens the annual emissions limits imposed on these large higher emitting plants and also sets restrictions on smaller, cleaner plants fired by coal, oil, and gas. All existing utility units with an output capacity of 25 megawatts or greater and all new utility units will be affected in phase II. The number of phase II units, affected capacity, and the percent of total state capacity are shown in Table 2-3. Total emissions, estimated allowances, and the required reduction for phase II are listed by state in Table 2-4. Figure 2-2 maps the percent of total SO_2

TABLE 2-1

AFFECTED NUMBER OF UNITS AND CAPACITY BY STATE IN PHASE I

State	Affected # of Units	Affected Capacity MW	% of Total
Alabama	10	3,363	15.7
Florida	5	2,284	6.3
Georgia	19	7,430	34.9
Illinois	17	6,010	16.3
Indiana	37	11,190	48.7
Iowa	6	976	11.2
Kansas	1	158	1.5
Kentucky	17	4,663	26.9
Maryland	6	2,380	20.5
Michigan	2	650	2.7
Minnesota	1	163	1.8
Mississippi	2	750	10.4
Missouri	16	6,546	39.3
New Hampshire	2	459	17.6
New Jersey	2	299	2.0
New York	10	2,407	7.2
Ohio	44	14,562	49.8
Pennsylvania	25	8,088	22.0
Tennessee	19	6,330	34.8
West Virginia	14	7,352	48.8
Wisconsin	13	2,740	24.8
TOTAL	268	88,800	

Source: Based on data from Edison Electric Institute, *Statistical Yearbook of the Electric Utility Industry/1989* (Washington, D.C.: Edison Electric Institute, 1990), Table 3; unpublished 1991 EPA, Acid Rain Division data; Clean Air Act Amendments of 1990, Table A; and authors' computations.

TABLE 2-2

SO_2 EMISSION AND ESTIMATED ALLOWANCE ALLOCATIONS BY STATE (PHASE I)

	Total SO_2 Emissions (Tons)	Total SO_2 Allowance* (Tons)	(%)	Required SO_2 Reduction** (Tons)	(%)
Alabama	526,452	230,940	4.05	64,310	1.70
Florida	593,873	133,130	2.34	105,041	2.77
Georgia	989,946	581,600	10.20	234,687	6.20
Illinois	988,669	394,256	6.92	386,818	10.21
Indiana	1,423,835	717,063	12.58	591,475	15.61
Iowa	196,584	40,290	0.71	33,493	0.88
Kansas	131,838	4,220	0.07	3,595	.09
Kentucky	796,652	278,250	4.88	187,255	4.94
Maryland	234,111	139,540	2.45	9,502	0.25
Michigan	427,799	42,340	0.74	16,934	0.45
Minnesota	117,298	4,270	0.07	556	0.01
Mississippi	104,375	54,610	0.96	18,546	0.49
Missouri	953,965	352,990	6.19	425,459	11.23
New Hampshire	72,581	32,190	0.56	13,901	0.37
New Jersey	92,301	20,780	0.36	12,325	0.33
New York	397,517	150,980	2.65	18,260	0.48
Ohio	2,243,991	960,200	16.85	946,940	25.00
Pennsylvania	1,154,185	534,140	9.37	130,523	3.45
Tennessee	806,882	386,430	6.78	254,824	6.73
West Virginia	942,784	497,870	8.74	246,885	6.52
Wisconsin	381,184	143,380	2.52	86,817	2.29
TOTAL	16,158,813	5,699,469		3,788,146	

Source: Clean Air Act Amendments of 1990, Table A; unpublished 1991 EPA data, Acid Rain Division; and authors' computations.

* Total allowances are based on Table A of the CAAA plus the pro rata share for Illinois, Indiana, and Ohio of the 200,000 bonus allowances. However, this does not represent the actual allowances that will be received by the affected sources because of the other bonus allowances.

**Total phase I required SO_2 reduction based on units in states that exceed the 2.5 pounds of SO_2/mmBtu requirement for units over 100 MW.

Fig. 2-1. Phase I SO_2 reduction by state--percent of total.

TABLE 2-3

AFFECTED NUMBER OF UNITS AND CAPACITY BY STATE IN PHASE II

State	Affected # of Units*	Affected Capacity MW	Affected Capacity % of Total
Alabama	28	6,490	30.4
Delaware	10	619	27.1
Florida	27	7,581	21.0
Georgia	34	9,755	45.9
Illinois	40	9,016	24.4
Indiana	67	13,534	58.9
Iowa	32	2,861	32.7
Kansas	8	1,381	12.8
Kentucky	31	8,120	46.8
Maine	4	241	9.9
Maryland	15	4,317	37.1
Massachusetts	15	3,911	38.8
Michigan	44	8,497	35.2
Minnesota	18	2,097	22.7
Mississippi	2	750	10.4
Missouri	33	9,721	58.3
Montana	1	191	3.9
Nebraska	2	337	5.9
New Hampshire	8	1,073	41.2
New Jersey	7	1,664	11.1
New York	47	6,739	20.2
North Carolina	38	10,743	51.4
North Dakota	6	1,185	25.3
Ohio	116	21,791	74.5
Pennsylvania	61	15,774	42.9
Rhode Island	4	179	65.1
South Carolina	21	3,873	22.2
South Dakota	1	456	16.7
Tennessee	33	9,780	53.7
Texas	8	4,981	7.5
Virginia	18	3,501	24.0
Washington	2	1,460	6.2
West Virginia	27	9,358	62.1
Wisconsin	50	5,388	48.7
Wyoming	3	743	12.0
TOTAL	861	188,107	

Source: Based on data from Edison Electric Institute; unpublished 1991 EPA, Acid Rain Division data; and authors' computations.

* For purposes of this table, affected units are units that exceed the phase II limit of 1.2 pounds of SO_2/mmBtu. As explained in Chapter 1, nearly all existing fossil-fueled units larger than 25 MW

are "affected units" under Title IV (over 2,700 units). In the context of the CAAA, a unit is defined as a fossil fuel-fired combustion device.

TABLE 2-4

SO_2 EMISSION AND ESTIMATED ALLOWANCE ALLOCATIONS BY STATE (PHASE II)

State	Total SO_2 Emissions (Tons)	Total SO_2 Allowance (Tons)	(%)	Required SO_2 Reduction* (Tons)	(%)
Alabama	526,452	305,510	3.63	239,294	2.93
Arizona	104,881	125,858	1.49	0	0.00
Arkansas	73,609	88,331	1.05	0	0.00
California	4,701	5,633	0.07	0	0.00
Colorado	83,336	97,872	1.16	0	0.00
Connecticut	60,877	73,049	0.87	0	0.00
Delaware	68,886	55,557	0.66	16,580	0.20
District of Columbia	1,345	1,614	0.02	0	0.00
Florida	593,873	372,171	4.42	251,511	3.08
Georgia	989,946	398,268	4.73	594,756	7.27
Illinois	988,669	374,540	4.45	631,421	7.72
Indiana	1,423,835	450,899	5.36	978,186	11.97
Iowa	196,584	115,831	1.38	88,735	1.09
Kansas	131,838	114,180	1.36	31,447	0.38
Kentucky	796,652	373,776	4.44	448,574	5.49
Louisiana	66,489	79,784	0.95	0	0.00
Maine	12,225	11,624	0.14	1,438	0.02
Maryland	234,111	133,797	1.59	104,649	1.28
Massachusetts	254,063	172,642	2.05	88,828	1.09
Michigan	427,799	374,293	4.45	68,667	0.84
Minnesota	117,298	86,510	1.03	34,055	0.42
Mississippi	104,375	61,832	0.73	46,943	0.57
Missouri	953,965	273,950	3.25	669,694	8.19
Montana	16,797	17,074	0.20	1,641	0.02

TABLE 2-4--Continued

State	Total SO_2 Emissions (Tons)	Total SO_2 Allowance (Tons)	(%)	Required SO_2 Reduction* (Tons)	(%)
Nebraska	46,922	55,049	0.65	222	0.00
Nevada	49,698	59,637	0.71	0	0.00
New Hampshire	72,581	32,568	0.39	40,013	0.49
New Jersey	92,301	60,165	0.71	31,706	0.39
New Mexico	71,726	85,567	1.02	0	0.00
New York	397,517	225,783	2.68	180,338	2.21
North Carolina	331,535	290,027	3.44	50,011	0.61
North Dakota	131,958	133,312	1.58	15,231	0.19
Ohio	2,243,991	672,048	7.98	1,570,506	19.21
Oklahoma	87,689	105,227	1.25	0	0.00
Oregon	898	1,078	0.01	0	0.00
Pennsylvania	1,154,185	564,988	6.71	598,333	7.32
Rhode Island	3,339	3,013	0.04	111	0.00
South Carolina	160,671	106,822	1.27	56,547	0.69
South Dakota	25,157	12,504	0.15	12,158	0.15
Tennessee	806,882	298,592	3.55	508,290	6.22
Texas	570,769	591,020	7.02	40,306	0.49
Utah	22,595	26,958	0.32	0	0.00
Vermont	155	25	0.00	0	0.00
Virginia	142,170	126,839	1.51	20,463	0.25
Washington	62,826	45,037	0.53	17,789	0.22
West Virginia	942,784	445,628	5.29	524,183	6.41
Wisconsin	381,184	172,448	2.05	211,266	2.58
Wyoming	126,674	140,398	1.67	1,448	0.02
TOTAL	16,158,813	8,419,328		8,175,340	

Source: Unpublished 1991 EPA data, Acid Rain Division; and authors' computations.

* Required SO_2 reduction is based on the number of units that exceed the phase II 1.2 pounds of SO_2/mmBtu requirement. Some units, however, will receive more allowances than needed. For this reason column 4 is *not* the difference between columns 1 and 2.

Fig. 2-2. Phase II SO_2 reduction by state--percent of total.

reduction required for each state. Almost one-third of the affected units and megawatt capacity are located in four states: Indiana, North Carolina, Ohio, and Pennsylvania. Seven states have over 50 percent of their total capacity affected in phase II: Indiana, Missouri, North Carolina, Ohio, Rhode Island, Tennessee, and West Virginia. Five more states have between 40 and 50 percent of their capacity affected: Georgia, Kentucky, New Hampshire, Pennsylvania, and Wisconsin. Indiana and Ohio again have the largest required reductions in emissions: 12.0 percent and 19.2 percent, respectively. The largest shares of allowances, each over 5 percent of the nation's total, go to Texas, Ohio, Pennsylvania, West Virginia, and Indiana.

The allocation of allowances is made to the owner, operator, or designated representative of an individual utility. Therefore, it is important to consider the concentration of allowances at the firm level. The effective functioning of markets is predicated upon competition, since the presence of market power could decrease the efficiency of the allowance trading market (discussed in more detail in Chapter 3). Tables 2-5 and 2-6 and Appendix B indicate that while the concentration of allowance holdings by a few firms appears substantial, these shares are reduced significantly in phase II.[1]

Although allowances will be distributed to individual operating companies, the decisions on how to use these allowances will depend on the operating agreement of the particular holding company. However, in order to indicate the possible presence of market power, the individual affiliate holdings of allowances were aggregated into the respective utility holding company. In phase I the twenty largest holdings of allowances account for about 80 percent of the total. By phase II this aggregate (with different members) is reduced to a little over half of the total emissions allowances available.

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[1] It should be noted that what is aggregated here is the total allowance allocation, not the allowances available for sale. These discretionary allowances would be useful also for determining market power, but at this time the numbers of allowances that will be retained for each utility's system use is not yet available. Moreover, as will be shown in the next chapter, the price of allowances and the utility's control-cost will determine the number of allowances made available for sale or purchased by a utility (and industrials that opt-in).

TABLE 2-5

TOP 20 COMPANY SHARES OF PHASE I EMISSION ALLOWANCES

Top 20 Companies	Phase I Allowances	Share of Total (%)
Southern Company**	821,160	14.4
American Electric Power**	557,717	9.8
Tennessee Valley Authority	552,640	9.7
Allegheny Power System Incorporated**	376,320	6.6
Public Service Company of Indiana	320,668	5.6
Union Electric Company	200,330	3.5
General Public Utilities Corporation**	191,340	3.4
Ohio Edison Company*	177,626	3.1
Illinois Power Company	175,938	3.1
Pennsylvania Power & Light Company	158,370	2.8
Centerior Energy Corporation	150,763	2.6
Dominion Resources Incorporated	121,730	2.1
Indiana-Kentucky Electric Corporation	120,190	2.1
Potomac Electric Power Company	119,980	2.1
IPALCO Enterprises Incorporated	97,768	1.7
Long Island Lighting Company	93,200	1.6
Ohio Valley Electric Corporation	93,200	1.6
Cincinnati Gas & Electric Company*	93,018	1.6
Associated Electric Cooperative Incorporated	90,360	1.6
TECO Energy Incorporated	82,250	1.4
Total Top 20	4,594,568	80.4

Source: Unpublished 1991 EPA, Acid Rain Division data and authors' computations.

* Multistate holding company.
**Multistate holding company registered under the PUHCA.

TABLE 2-6

TOP 20 COMPANY SHARES OF PHASE II EMISSION ALLOWANCES

Top 20 Companies	Phase II Allowances	Share of Total (%)
Southern Company**	712,792	8.5
American Electric Power**	503,796	6.0
Tennessee Valley Authority	459,401	5.5
Texas Utilities Company	268,861	3.2
General Public Utilities Corporation**	238,461	2.8
Detroit Edison Company	227,061	2.7
Allegheny Power System Incorporated**	217,946	2.6
PacifiCorp	201,305	2.4
Pennsylvania Power & Light Company	171,150	2.0
Ohio Edison Company	155,719	1.8
Duke Power Company	151,748	1.8
Public Service Company of Indiana	149,491	1.8
Carolina Power & Light Company	145,611	1.7
Dominion Resources Incorporated	145,143	1.7
Commonwealth Edison Company*	136,477	1.6
Union Electric Company	134,946	1.6
Central and South West Corporation**	131,387	1.6
Florida Progress Corporation	118,310	1.4
Centerior Energy Corp.	110,873	1.3
DPL Incorporated	107,362	1.3
Total Top 20	4,487,840	53.3

Source: Unpublished 1991 EPA, Acid Rain Division data and authors' computations.

* Multistate holding company.
**Multistate holding company registered under the PUHCA.

The Southern Company, American Electric Power, the Tennessee Valley Authority, and Allegheny Power System jointly account for over 40 percent of the market in phase I. By phase II this concentration is reduced to one-fifth of the market.

Market concentration is an important measure of market power. Several indices of market share are available. The best known is the Herfindahl-Hirshman Index (HHI) adopted by the U.S. Department of Justice as a standard for implementing antitrust policies in approving mergers.[2] In phase I the HHI value is 0.058 and in phase II it is 0.024. This suggests that the concentration of market power will not be a problem in either phase. As the market develops, however, allowances could become more concentrated among utilities that have more discretionary allowances (that is, more allowances available for sale). If this situation were to develop then the price of allowances could be affected. State commission and FERC action on compliance costs and allowances could lead to this outcome to the extent they influence the overcontrol and banking decisions of an industry. But the conjecture here is that concentration is sufficiently low to make this also unlikely.

It should be acknowledged that there is a school of thought on antitrust matters that would question the validity of HHI. This "new industrial organization" envisions the existence of markets where, even though incumbent firms have increasing returns to scale or high market shares, the market may, under certain conditions, be "perfectly

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[2] The HHI is a compound index that uses both the number of sellers in the market as well as their sizes. It is given by

$$HHI = \sum_{i=1}^{n} s_i^2$$

where s_1 equals the percentage share or fraction of the market accounted for the ith firm. The reciprocal of the HHI equals the equivalent number of sellers of equal size. As an example, an HHI value of 0.125 is equivalent to eight sellers having equal market shares. HHI values close to one reflect high concentration (and market power) and values close to zero reflect low concentration.

contestable." In this case, potential entry and the resulting price competition are sufficiently effective to discipline existing firms. Hence, even a highly concentrated industry may be quite competitive. Again, the HHI shows that even without this consideration, concentration in the emission allowance market falls substantially from phase I to phase II and is not likely to be a significant problem.

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