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Acid Rain Clean-up Costs

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The problem: Emissions and acid rain

A major problem of coal burning electric plants is emissions of sulfur dioxide (SO_2) and nitrogen oxides (NO_x). "In Eastern North America, fossil fuel combustion is responsible for more than 90 percent of the sulfur and nitrogen oxides (SO_x and NO_x) emitted to the atmosphere" (Johnson, 1986). Most current emissions of sulfur (eleven to fifteen million tons per year in eastern North America) come from coal combustion. Fossil fuels containing sulfur are burned, yielding sulfur oxides into the atmosphere. "Nitrogen oxides are produced from atmospheric nitrogen during high-temperature combustion of fossil fuels...Sulfur dioxide and nitrogen oxides are converted in the atmosphere to sulfuric and nitric acids,...which are removed from the atmosphere by wet and dry deposition processes" (Johnson, 1986). The wet deposition is often referred to as "acid rain". The results of acid rain are the subject of a fairly new debate, because "in essentially every case in which acid deposition has been suspected to be a factor in causing a change in the environment, an alternative explanation based on other human activities or natural phenomena has been proposed" (Johnson, 1986).

Many disruptions in the ecosystems of lakes and forests have occurred, however, at a heightened rate following the increase in industrial activity in the early 1900's (Johnson, 1986). Tests done on precipitation indicate that precipitation in the eastern United States is more acidic now than in the mid

1950's or 1960's. "Concentrations of sulfate and nitrate in precipitation that are...at least [five times greater] than those in remote areas of the world" have been found in the eastern states (Johnson, 1986). Normal rainfall has a pH of 5.6, however, "sulfur and nitrogen oxides from industrial pollution can increase the acidity of rain several hundred times" (Sargent, 1985). In Baltimore and the surrounding areas, for example, rain with pH as low as 2.9 has been recorded. Tests measuring sulfate inputs and outputs of lakes indicate that "sulfate deposited from the atmosphere is finding its way into surface waters in the Northeast" (Johnson, 1986). The tests also indicate that "trends in stream sulfate are consistent with trends in SO_2 ...emissions" (Johnson, 1986). A study of the Adirondack lakes showed the most rapid changes in the pH of the lakes transpired between 1930 and 1970. "Analysis of the available land-use data...led to the conclusion that the recent rapid declines in lake-water pH are related to increased acid deposition...The three year study [of the Adirondack lakes] shows that there is no longer reasonable doubt that aquatic ecosystems are affected by sulfur emissions. The extent of the adverse effects, however, is not clear" (Johnson, 1986).

Many decreases in fish and tree populations have been blamed on acid rain. In the Chesapeake, where striped bass once flourished, the populations are at an all-time low (Sargent, 1985). High concentrations of acid have been recorded in the bay, and "below [a pH of] 7, striped bass eggs and larvae have difficulty surviving" (Sargent, 1985). In Canada, maple trees

have been dying at a much faster rate than normal. The usual expiration rate of the trees is two percent per year; however, they have been dying at a rate of ten to twenty percent per year for the last several years. Although there may be several contributing factors, researchers are sure acid rain plays a large roll in the death of the maples. The town in which the decline in trees was first noticed "receives 18 to 27 pounds of sulfate deposit from acid rain per acre per year, one of the highest levels of acidic precipitation in the province" (Wallace, 1985).

The first step to reducing acid rain is to decrease emissions of sulfur dioxide into the atmosphere. The method of reduction currently in use is scrubbing. The process of scrubbing treats the smoke given off from the burning of coal with limestone. The smoke emitted is sent through a duct lined with limestone. The limestone then produces a chemical reaction with the sulfur dioxide, and emissions into the atmosphere are lowered.

The bill: Acid Deposition Control Act of 1986, H.R. 4567

Bill H.R. 4567, the "Acid Deposition Control Act of 1986", called for the clean-up of emissions from fossil fuel burning plants. Although the original version of the bill was scrapped, it is still undergoing alterations. According to H.R. 4567, the clean-up process was to be completed in two phases. Phase I of the clean-up was to be realized by January 1, 1993, at which time sulfur dioxide emissions were not to exceed "an annual average rate of 2.0 pounds per million Btu of heat input" (H.R. 4567). A study was to be conducted "to determine the reduction in acid deposition achieved pursuant to phase I requirements" (H.R. 4567). At the end of phase II, the average annual rate of sulfur dioxide was not to exceed 1.2 pounds per million Btu, while nitrogen oxides were not to exceed 0.6 pounds per million Btu, by January 1, 1997. The plants were to be routinely inventoried to test emissions to see that they comply with the standards set. The states were allowed to "provide for compliance with the requirements...through any emission limitations and other requirements which the State deems appropriate" (H.R. 4567). Also, the states were to make sure that there was no "unnecessarily disproportionate economic effect on electric utility ratepayers in any region of the State or in any utility service area" (H.R. 4567). A subsidy program was to be instituted to protect residential utility customers from "excessive rate increases due to the imposition of sulfur dioxide emission reduction requirements" (H.R. 4567). Subsidies were to

be distributed if the rate increase was the direct result of the enactment of sulfur dioxide emission requirements and the increase in utility rates exceeded ten percent. In order to be eligible to receive the subsidy, the plant must have met three criteria: first, the system the company installed to reduce emissions must have been installed on a

> steam generating unit in order to comply with emission limitations established for that unit under State plan provisions adopted; ...[second,] the steam generating unit [was] specifically designated by the Governor of the State as a unit on which a technological system of continuous emission control [was] to be installed for purposes of meeting such emission limitations,...[and finally,] the construction of the steam generating unit commenced on or before September 18, 1978 (H.R. 4567).

A fee was to be assessed to the electric utilities to raise the funds necessary for the subsidy payments. It was to "vary in proportion to the sulfur dioxide emission rate so that a higher fee [would] be imposed in the case of a higher sulfur dioxide emissions rate" (H.R. 4567). This fee was not to "exceed 1/2 mill per kilowatt hour", and it was to apply only to electric energy generated by the burning of fossil fuels (H.R. 4567). Penalties were to be assessed for failure to pay the fee. A fund, called the "Acid Deposition Control Fund", was to be established, and investments in public debt securities were to be made with this fund as the Secretary of the Treasury saw fit.

The procedure: Determining government subsidy

The first step to determining government subsidy monies was to gather results from the Coal Technology Laboratory/Coal Supply Transportation Model (CTL/CSTM). The CTL/CSTM is a computer simulation of coal demand forecasts developed by a group of researchers at Southern Illinois University at Carbondale. The country was divided into 44 demand regions, each region was divided into "jobs", and each job was matched with specific plants. "Output from CTL/CSTM for each job indicates a shipment of coal to one or more plants, characterized by the amount of coal shipped, its mine-mouth and transportation costs, its Btu content, and its sulfur content" (Arey et al, 1987). The amount of coal to be treated is indicated in the "SUB BTU X 10E12" column. The calculated expense of purchasing, installing, and operating the advanced technology necessary to reduce emissions is in the "SUB $ X 10E6" column. Each of these figures, including the region, job, and company matches were obtained from the CTL/CSTM.

Next, a percentage of the coal supplied to each company in a job was found. The total thousand short tons for each job was divided into the sum of thousand short tons supplied to all the plants of a particular company in that job. This percentage is stated in the "% OF SUPPL" column.

The total operating revenue for 1985 for each company was then obtained ("$ GENERATED" column). Since the CTL/CSTM was in 1980 dollars and the operating revenues were in 1985 dollars, it

was necessary to discount the revenues by dividing by a factor of 1.29, as determined from a price index table. The result is expressed in the column "$ / 1.29".

The bill stated that the companies were expected to raise their prices at most ten percent to cover the cost of buying, installing, and operating the scrubbers ("10% OR CARRY-OVER"). Using the percentage previously found, the company's portion of money to be contributed to the job was calculated by multiplying the percent figure by the discounted price ("% OF SUB $"). The difference between the ten percent price raise and the percentage of money the company was expected to raise is in the "10% - SUB $" column. If the result was positive, the company received no subsidy, since the costs associated with the scrubbers could be covered with a ten percent or less increase in prices. However, if the difference was negative, the company received the difference from the government in the form of a subsidy ("SUB AMT").

Since a company could appear in more than one job or region, running totals were kept of the positive amount of money the company had left after contributing its portion to a job. Each time the company appeared, the new amount was used until the balance (carry-over amount) was zero. At that time, the company started receiving subsidies from the federal government for its portion of the costs, since a zero balance indicated a company raised its rates the full ten percent, and all monies generated were used.

The revenues for two companies could not be found, so an

average of the revenues for the region was used. These companies were Region 25, Job 16, Hoosier Energy, and Region 32, Job 15, Eastern Iowa Light and Power Company. Also, some companies did not have their operating revenues published, so they were contacted by phone for this figure.

Conclusion

Sulfur dioxide and nitrogen oxides emitted from coal-fired plants are changed into acids in the atmosphere. These acids are released through wet and dry deposition processes. The acidity from rainfall, "acid rain", leads to an increase in the acidity of surface water. Researchers know this increase in acidity can lead to a disruption in the ecosystems of the lakes and streams, but much research still needs to be done on the exact effects of acid rain.

The "Acid Deposition Control Act of 1986", bill H.R. 4567, was established to reduce emissions from coal burning plants. The bill also provided for government subsidies to reduce economic strain on residential customers due to the rate increase necessary to cover the costs of purchasing, installing and operating the advanced technology needed to decrease emissions. Subsidies were provided if the money needed exceeded a ten percent increase in utility rates.

The methods set forth in the bill, along with the Coal Technology Laboratory/Coal Supply Transportation Model, were used to determine the amount of government subsidy necessary for each company to install scrubbers. The amount of subsidy money needed totals $1.8 billion. 2.5 million million kilowatt hours of all types of electricity were sold by privately, publicly, and cooperatively owned electric companies in 1985. Since the majority (77.8%) of these companies are privately owned, it is safe to assume that the percentage for the steam energy generated

by private utilities (77.5%) was about the same as the steam energy generated by all utilities, since no such figure was available for all utilities. 77.5% of 2.5 million million kilowatt hours results in 1.9 million million kilowatt hours of electricity generated by steam. By taking the ratio between the total subsidy money and total kilowatt hours sold, an amount for the fee to be assessed per kilowatt hour can be found. In this case, a fee of 9/10 mill should be charged. The bill, though, states that the fee is not to exceed 1/2 mill, so nearly 1/2 mill would need to be raised by another method.

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APPENDIX A

JOB	COMPANY	SUB BTU x10E12	SUB $ x10E6	% SUPPL	$ GENERATED	$/1.29
REGION 1						
15	PUB SERV CO OF NH	37.511	22.896	100	519,739,592	402,898,909
REGION 2						
13	MONTAUP ELEC CO			12.9	254,894,233	197,592,429
	NEW ENGLAND PWR CO			83.3	1,016,400,076	787,907,036
	UNITED ILLUMINATION			3.8	514,936,496	399,175,578
		90.722	55.984			
14	HOLYOKE WATER & PWR			36.8	26,755,907	20,741,013
	NEW ENGLAND PWR CO			63.2	1,016,400,076	787,907,036
		34.530	21.309			
REGION 3						
14	NY STATE ELEC & GAS			55.3	1,051,578,367	815,177,029
	NIAGARA MOHAWK PWR			44.7	2,078,134,522	1,610,956,993
		140.998	85.941			
15	NIAGARA MOHAWK PWR			62.8	2,078,134,522	1,610,956,993
	ROCHESTER GAS & ELEC			37.2	473,553,467	367,095,711
		49.845	30.366			
REGION 4						
13	ATLANTIC CITY ELEC			10.9	579,732,674	449,405,174
	PUB SERV ELEC & GAS			84.4	3,000,564,466	2,326,018,965
	VINELAND ELEC DEPT			4.7	24,165,813	18,733,188
		64.314	39.688			
14	JMSTWN BD OF PUB UTL	3.004	1.854	100	14,247,941	11,044,916
15	ATLANTIC CITY ELEC	22.720	14.020	100	579,732,674	449,405,174
REGION 5						
14	METROPOLITAN EDSN CO			8.9	636,746,382	493,601,847
	PENN PWR & LT CO			91.1	1,971,318,234	1,528,153,669
		308.162	175.760			
REGION 6						
14	DUQUESNE LT CO			7.5	868,815,238	673,500,184
	PENN ELEC CO			66.4	768,054,604	595,391,166
	PENN PWR CO			5.7	224,696,075	174,183,004
	WEST PENN PWR CO			20.4	833,584,033	646,189,173
		430.639	247.483			
15	PENN ELEC CO	119.216	68.516	100	768,054,604	595,391,166

REGION/ JOB	10% (OR CARRY-OVER)	% OF SUB $	10% - SUB$	SUB AMT
REGION 1				
15	40,289,891	22,896,000	17,393,891	- 0 -
REGION 2				
13	19,759,243	7,221,936	12,537,307	- 0 -
	78,790,704	46,634,672	32,156,032	- 0 -
	39,917,558	2,127,392	37,790,166	- 0 -
14	2,074,101	7,841,712	-5,767,611	5,767,611
	32,156,032	13,467,288	18,688,744	- 0 -
REGION 3				
14	81,517,703	47,525,373	33,992,330	- 0 -
	161,095,699	38,415,627	122,680,072	- 0 -
15	122,680,072	19,069,848	103,610,224	- 0 -
	36,709,571	11,296,152	25,413,419	- 0 -
REGION 4				
13	44,940,517	4,325,992	40,614,525	- 0 -
	232,601,897	33,496,672	199,105,225	- 0 -
	1,873,319	1,865,336	7,983	- 0 -
14	1,104,492	1,854,000	-749,508	749,508
15	40,614,525	14,020,000	26,594,525	- 0 -
REGION 5				
14	49,360,185	15,642,640	33,717,545	- 0 -
	152,815,367	160,117,360	-7,301,993	7,301,993
REGION 6				
14	67,350,018	18,561,225	48,788,793	- 0 -
	59,539,117	164,328,712	-104,789,595	104,789,595
	17,418,300	14,106,531	3,311,769	- 0 -
	64,618,917	50,486,532	14,132,385	- 0 -
15	59,539,117	- 0 -	-68,516,000	68,516,000

JOB	COMPANY	SUB BTU x10E12	SUB $ x10E6	% SUPPL	$ GENERATED	$/1.29
REGION 7						
14	MONONGAHEIA POWER CO			34.8	499,431,970	387,156,566
	OHIO POWER CO			27.8	1,382,177,877	1,071,455,718
	VA ELEC & POWER CO			37.4	2,586,288,082	2,004,874,482
		238.208	141.820			
15	MONONGAHEIA POWER CO	118.203	70.340	100	499,431,970	387,156,566
16	OHIO POWER CO	51.476	30.632	100	1,382,177,877	1,071,455,718
REGION 9						
13	APPALACHIAN POWER CO			15.2	1,323,031,686	1,025,605,958
	POTOMAC ELEC PWR CO			28.8	1,315,698,672	1,019,921,451
	VA ELEC & POWER CO			56.0	2,586,288,082	2,004,874,482
		92.965	53.023			
14	VA ELEC & POWER CO	76.174	43.446	100	2,586,288,082	2,004,874,482
REGION 10						
14	POTOMAC ELEC PWR CO	204.917	126.032	100	1,315,698,672	1,019,921,451
15	BALT GAS & ELEC CO	20.154	12.395	100	1,301,462,835	1,008,885,918
REGION 11						
14	CAROLINA PWR & LT CO			32.1	1,934,714,578	1,499,778,742
	DUKE POWER CO			2.5	2,899,661,273	2,247,799,436
	S. CARLNA ELEC & GAS			65.4	788,699,943	611,395,305
		206.022	117.659			
REGION 12						
14	GEORGIA POWER CO	466.337	291.527	100	3,444,298,641	2,669,998,946
15	GEORGIA POWER CO	291.511	182.235	100	3,444,298,641	2,669,998,946
16	GEORGIA POWER CO	9.754	5.563	100	3,444,298,641	2,669,998,946
REGION 13						
15	GULF POWER CO	92.963	58.953	100	518,223,638	401,723,750
16	TAMPA ELECTRIC CO	90.321	57.280	100	861,423,787	667,770,378
REGION 15						
14	EAST KY RURAL ELEC			58.4	233,168,362	180,750,668
	KENTUCKY POWER CO			41.6	260,417,779	201,874,247
		148.410	85.587			

REGION/ JOB	10% (OR CARRY-OVER)	% OF SUB $	10% - SUB$	SUB AMT
REGION 7				
14	38,715,657	49,353,360	-10,637,703	10,637,703
	107,145,572	39,425,960	67,719,612	- 0 -
	200,487,448	53,040,680	147,446,768	- 0 -
15	- 0 -	70,340,000	-70,340,000	70,340,000
16	67,719,612	30,632,000	37,087,612	- 0 -
REGION 9				
13	102,560,596	8,059,496	94,501,100	- 0 -
	101,992,145	15,270,624	86,721,521	- 0 -
	147,446,768	29,692,880	117,753,888	- 0 -
14	117,753,888	43,446,000	74,307,888	- 0 -
REGION 10				
14	86,721,521	126,032,000	-39,310,479	39,310,479
15	100,888,592	12,395,000	88,493,592	- 0 -
REGION 11				
14	149,977,874	37,768,539	112,209,335	- 0 -
	224,779,944	2,941,475	221,838,469	- 0 -
	61,139,531	76,948,986	-15,809,455	15,809,455
REGION 12				
14	266,999,895	291,527,000	-24,527,105	24,527,105
15	- 0 -	182,235,000	-182,235,000	182,235,000
16	- 0 -	5,563,000	-5,563,000	5,563,000
REGION 13				
15	40,172,375	58,953,000	-18,780,625	18,780,625
16	66,777,038	57,280,000	9,497,038	- 0 -
REGION 15				
14	18,075,067	49,982,808	-31,907,741	31,907,741
	20,187,425	35,604,192	-15,416,767	15,416,767

JOB	COMPANY	SUB BTU x10E12	SUB $ x10E6	% SUPPL	$ GENERATED	$/1.29
REGION 16						
14	KENTUCKY UTILITIES			38.5	527,288,044	408,750,422
	TENNESSEE VALLEY AUT			61.5	4,547,487	3,525,184
		41.258	27.456			
15	BIG RIVERS RURAL ELC			88.2	236,023,720	182,964,124
	HENDERSON MUNIC PWR			2.9	21,495,820	16,663,426
	KENTUCKY UTILITIES			8.9	527,288,044	408,750,422
		130.423	86.793			
16	OWENSBORO MUNIC UTIL	69.732	46.405	100	47,707,474	36,982,538
REGION 17						
14	TENNESSEE VALLEY AUT	72.147	43.019	100	4,547,487	3,525,184
REGION 18						
14	TENNESSEE VALLEY AUT	52.753	33.914	100	4,547,487	3,525,184
15	TENNESSEE VALLEY AUT	306.511	197.050	100	4,547,487	3,525,184
REGION 19						
14	ALABAMA POWER CO	167.128	100.242	100	2,414,218,592	1,871,487,280
15	MISSISSIPPI POWER CO			39.5	446,797,159	346,354,387
	TENNESSEE VALLEY AUT			60.5	4,547,487	3,525,184
		133.411	80.019			
16	TENNESSEE VALLEY AUT	53.218	31.940	100	4,547,487	3,525,184
REGION 20						
14	PAINESVILLE ELC & LT			4.1	1,253,989,614	972,084,972
	TOLEDO EDISON CO			76.9	589,172,731	456,723,047
	OHIO EDISON CO			19.0	1,543,389,684	1,196,426,111
		33.787	20.850			
15	CLEVELAND ELEC ILLUM	82.624	50.987	100	1,240,884,849	961,926,240
16	CLEVELAND ELEC ILLUM	65.556	40.454	100	1,240,884,849	961,926,240
REGION 21						
15	OHIO EDISON CO			4.6	1,543,389,684	1,196,426,111
	COLMBS & S OHIO ELEC			95.4	692,583,578	536,886,495
		7.810	4.820			
16	OHIO EDISON CO			45.0	1,543,389,684	1,196,426,111
	COLMBS & S OHIO ELEC			55.0	692,583,578	536,886,495
		87.082	53.738			

REGION/ JOB	10% (OR CARRY-OVER)	% OF SUB $	10% - SUB$	SUB AMT
REGION 16				
14	40,875,042	10,570,560	30,304,482	- 0 -
	352,518	16,885,440	-16,532,922	16,532,992
15	18,296,412	76,551,426	-58,255,014	58,255,014
	1,666,343	2,519,997	-853,654	853,654
	30,304,482	7,724,577	22,579,905	- 0 -
16	3,698,254	46,405,000	-42,706,746	42,706,746
REGION 17				
14	- 0 -	43,019,000	-43,019,000	43,019,000
REGION 18				
14	- 0 -	33,914,000	-33,914,000	33,914,000
15	- 0 -	197,050,000	-197,050,000	197,050,000
REGION 19				
14	187,148,728	100,242,000	86,906,728	- 0 -
15	34,635,439	31,607,505	3,027,934	- 0 -
	- 0 -	48,411,495	-48,411,495	48,411,495
16	- 0 -	31,940,000	-31,940,000	31,940,000
REGION 20				
14	97,208,497	854,850	96,353,647	- 0 -
	45,672,305	16,033,650	29,638,655	- 0 -
	119,642,611	3,961,500	115,681,111	- 0 -
15	96,192,624	50,987,000	45,205,624	- 0 -
16	45,205,624	40,454,000	4,751,624	- 0 -
REGION 21				
15	115,681,111	221,720	115,459,391	- 0 -
	53,688,650	4,598,280	49,090,370	- 0 -
16	115,459,391	24,182,100	91,277,291	- 0 -
	49,090,370	29,555,900	19,534,470	- 0 -

JOB	COMPANY	SUB BTU x10E12	SUB $ x10E6	% SUPPL	$ GENERATED	$/1.29
REGION 22						
14	DAYTON POWER & LT CO			45.9	694,094,030	538,057,388
	CINCINNATI GAS & ELC			22.5	927,177,129	718,741,960
	OHIO EDISON CO			31.6	1,543,389,684	1,196,426,111
		286.286	176.411			
15	CARDINAL OPERATING			73.7	189,000,000	146,511,628
	CINCINNATI GAS & ELC			26.3	927,177,129	718,741,960
		49.164	30.295			
16	OHIO EDISON CO			11.4	1,543,389,684	1,196,426,111
	OHIO POWER CO			67.5	1,382,177,877	1,071,455,718
	OHIO VALLEY ELEC CO			21.1	306,926,930	237,927,853
		484.391	298.484			
REGION 23						
13	CONSUMER'S POWER CO			66.4	1,697,243,094	1,315,692,320
	DETROIT EDISON CO			15.4	2,737,020,292	2,121,721,156
	UPPER PENINSULA PWR			18.2	56,689,975	43,945,717
		276.985	175.471			
14	CONSUMER'S POWER CO	18.905	11.976	100	1,697,243,094	1,315,692,320
15	DETROIT EDISON CO	192.790	122.132	100	2,737,020,292	2,121,721,156
16	DETROIT EDISON CO	2.888	1.844	100	2,737,020,292	2,121,721,156
REGION 24						
14	ELECTRIC ENERGY INC	86.019	55.866	100	180,781,797	140,140,928
15	CENT IL PUB SERV CO			55.	529,899,783	410,775,026
	ILLINOIS POWER CO			22.0	766,466,944	594,160,422
	SPRINGFLD WTR,LT&PWR			22.9	80,387,731	62,316,071
		64.312	42.261			
16	CENT IL PUB SERV CO			15.4	529,899,783	410,775,026
	COMMONWEALTH EDISON			24.8	4,964,151,124	3,848,179,165
	ILLINOIS POWER CO			52.4	766,466,944	594,160,422
	SOUTHERN IL PWR COOP			7.4	35,825,175	27,771,453
		263.214	170.261			
REGION 25						
14	RICHMOND PWR & LT CO	7.936	5.083	100	29,669,414	22,999,546
15	INDIANA & MICH ELEC			6.4	1,059,777,176	821,532,695
	INDINAPLS PWR & LT			27.6	442,713,823	343,189,010
	PUB SERV CO OF IND			66.0	974,963,313	755,785,514
		256.208	164.046			

REGION/ JOB	10% (OR CARRY-OVER)	% OF SUB $	10% - SUB$	SUB AMT
REGION 22				
14	53,805,739	80,972,649	-27,166,910	27,199,910
	71,874,196	39,692,475	32,181,721	- 0 -
	91,277,291	55,745,876	35,531,415	- 0 -
15	14,651,163	22,327,415	-7,676,252	7,676,272
	32,181,721	7,967,585	24,214,136	- 0 -
16	35,531,415	34,027,176	1,504,239	- 0 -
	37,087,612	201,476,700	-164,389,088	164,389,088
	23,792,785	62,980,124	-39,187,339	39,187,339
REGION 23				
13	131,569,232	116,512,744	15,056,488	- 0 -
	212,172,116	27,022,534	185,149,582	- 0 -
	4,394,572	31,935,722	-27,541,150	27,541,150
14	15,056,488	11,976,000	3,080,488	- 0 -
15	185,149,582	122,132,000	63,017,582	- 0 -
16	63,017,582	1,844,000	61,173,582	- 0 -
REGION 24				
14	14,014,093	55,866,000	-41,851,907	41,851,907
15	41,077,503	23,285,811	17,791,692	- 0 -
	59,416,042	9,297,420	50,118,622	- 0 -
	6,231,607	9,677,769	-3,466,162	3,466,162
16	17,791,692	26,220,194	-8,428,502	8,428,502
	384,817,917	42,224,728	342,593,189	- 0 -
	50,118,622	89,216,764	-39,098,142	39,098,142
	2,777,145	12,599,314	-9,822,169	9,822,169
REGION 25				
14	2,299,955	5,083,000	-2,783,045	2,783,045
15	82,153,270	10,498,944	71,654,326	- 0 -
	34,318,901	45,276,696	-10,957,795	10,957,795
	75,578,551	108,270,360	-32,691,809	32,691,809

JOB	COMPANY	SUB BTU x10E12	SUB $ x10E6	% SUPPL	$ GENERATED	$/1.29
REGION 25						
16	HOOSIER ENERGY			6.1	666,202,460	516,436,016
	INDIANA & MICH ELEC			8.3	1,059,777,176	821,532,695
	INDIANA-KENTUCKY ELC			33.1	148,781,485	115,334,484
	NRTHN IND PUB SERV			23.3	964,647,640	747,788,868
	PUB SERV CO OF IND			15.1	974,963,313	755,785,514
	STHN IND GAS & ELEC			14.1	182,842,686	141,738,516
		400.438	256.394			
REGION 26						
14	DAIRYLAND PWR COOP			3.9	159,799,307	123,875,432
	MADISON GAS & ELEC			16.9	122,802,425	95,195,678
	WISCONSIN ELEC PWR			79.2	1,086,192,364	842,009,584
		23.507	14.506			
15	DAIRYLAND PWR COOP			23.7	159,799,307	123,875,432
	WISCONSIN ELEC PWR			76.3	1,086,192,364	842,009,584
		97.119	59.932			
16	WISCONSIN PWR & LT	50.903	31.412	100	428,905,010	332,484,504
REGION 27						
14	NRTHN STATES PWR CO	7.018	4.686	100	1,305,733,330	1,012,196,379
16	RCHSTR DPT OF PUB UT	0.096	0.064	100	27,739,601	21,503,567
REGION 32						
14	INTERSTATE POWER CO	0.239	0.160	100	204,925,702	158,857,133
15	EASTRN IOWA LT & PWR			9.0	187,036,223	144,989,320
	INTERSTATE POWER CO			43.2	204,925,702	158,857,133
	IOWA ELEC, LT & PWR			47.8	291,624,398	226,065,425
		34.190	22.828			
16	IOWA STHRN UTIL CO			60.2	97,051,446	75,233,679
	IOWA-IL GAS & ELEC			13.3	272,962,894	211,599,143
	MUSKATINE PWR & WTR			26.5	68,616,674	53,191,220
		20.696	13.819			
REGION 33						
14	ASSOC ELEC COOP-MO	180.245	116.668	100	393,127,479	304,749,984
15	UNION ELECTRIC CO	123.772	80.113	100	1,489,257,005	1,154,462,794

REGION/ JOB	10% (OR CARRY-OVER)	% OF SUB $	10% - SUB$	SUB AMT
REGION 25				
16	51,643,602	15,640,034	36,003,568	- 0 -
	71,654,326	21,280,702	50,373,624	- 0 -
	11,533,448	84,866,414	-73,332,966	73,332,966
	74,778,887	59,739,802	15,039,085	- 0 -
	- 0 -	38,715,494	-38,715,494	38,715,494
	14,173,852	36,151,554	-21,977,702	21,977,702
REGION 26				
14	12,387,543	565,734	11,821,809	- 0 -
	9,519,568	2,451,514	7,068,054	- 0 -
	84,200,958	11,488,752	72,712,206	- 0 -
15	11,821,809	14,203,884	-2,382,075	2,382,075
	72,712,206	45,728,116	26,984,090	- 0 -
16	33,248,450	31,412,000	1,836,450	- 0 -
REGION 27				
14	101,219,638	4,686,000	96,533,638	- 0 -
16	2,150,357	64,000	2,086,357	- 0 -
REGION 32				
14	15,885,713	160,000	15,725,713	- 0 -
15	14,498,932	2,054,520	12,444,412	- 0 -
	15,725,713	9,861,696	5,864,017	- 0 -
	22,606,543	10,911,784	11,694,759	- 0 -
16	7,523,368	8,319,038	-795,670	795,670
	21,159,914	1,837,927	19,321,987	- 0 -
	5,319,122	3,662,035	1,657,087	- 0 -
REGION 33				
14	30,474,998	116,668,000	-86,193,002	86,193,002
15	115,446,279	80,113,000	35,333,279	- 0 -

JOB	COMPANY	SUB BTU x10E12	SUB $ x10E6	% SUPPL	$ GENERATED	$/1.29
REGION 33						
16	ASSOC ELEC COOP-MO			35.6	393,127,479	304,749,984
	CTRL ELC PWR COOP-MO			2.8	33,057,963	25,626,328
	COLUMBIA WTR & LT CO			0.7	34,092,935	26,428,632
	EMPIRE DIST ELEC CO			8.9	126,429,810	98,007,605
	INDEPNDNCE PWR & LT			2.3	37,120,359	28,775,472
	KANSAS CITY PWR & LT			15.6	583,112,639	452,025,302
	CTY UTIL OF SPRNGFLD			4.7	74,222,000	57,536,434
	ST JOSEPH LT & PWR			1.0	68,005,668	52,717,572
	UNION ELECTRIC CO			28.4	1,489,257,005	1,154,462,794
		221.307	143.247			

REGION/ JOB	10% (OR CARRY-OVER)	% OF SUB $	10% - SUB$	SUB AMT
REGION 33				
16	- 0 -	50,995,932	-50,995,932	50,995,932
	2,562,633	4,010,916	-1,448,283	1,448,283
	2,642,863	1,002,729	1,640,134	- 0 -
	9,800,761	12,748,983	-2,948,222	2,948,222
	2,877,547	3,294,681	-417,134	417,134
	45,202,530	22,346,532	22,855,998	- 0 -
	5,753,643	6,732,609	-978,966	978,966
	5,271,757	1,432,470	3,839,287	- 0 -
	35,333,279	40,682,148	-5,348,869	5,348,869