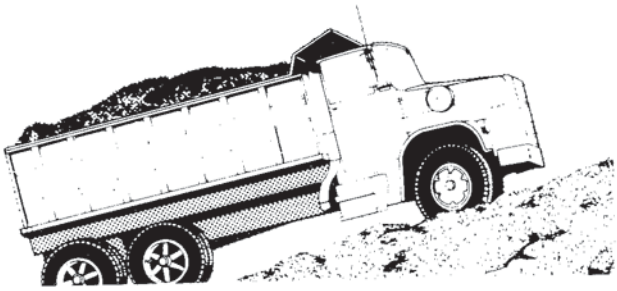
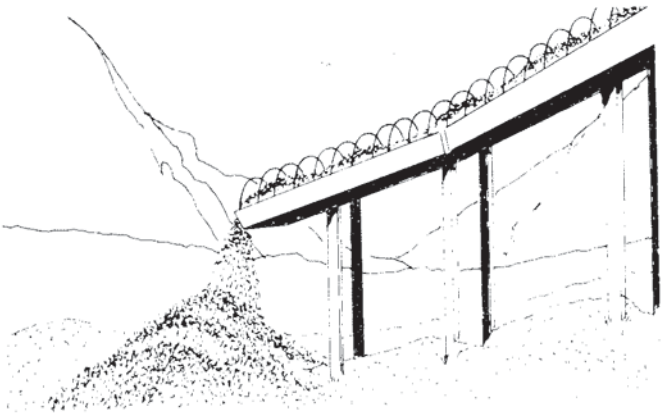
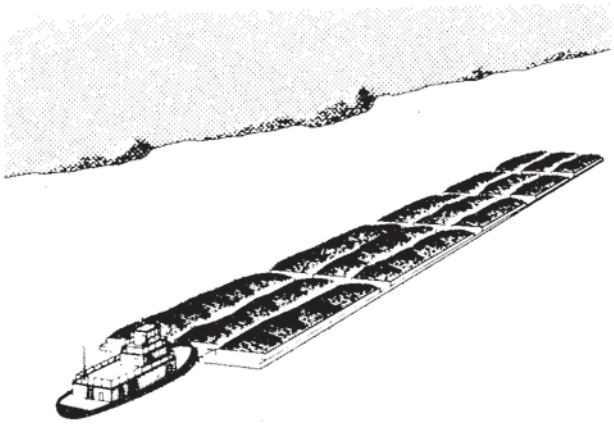
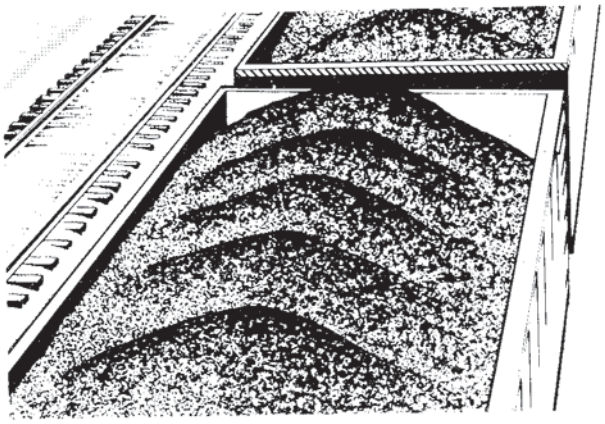
COAL TRANSPORTATION
IN THE SOUTH









Informational Bulletin No. 140

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Frankfort, Kentucky

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COAL TRANSPORTATION
IN THE SOUTH

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Informational Bulletin No. 140

Legislative Research Commission
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INTRODUCTION

After decades of decline, coal is beginning to re-emerge as a leading energy source. At the end of World War II, coal supplied half of the nation's energy consumption. By 1972, the year before the Organization of Petroleum Exporting Countries' (OPEC) oil boycott, coal's share had dropped to just over 17 percent.[1] That historic boycott by the oil exporters brought public attention to the precariousness of the supply of fuels the nation had come increasingly to rely on for its energy. The fear of shortage and the startling jump in prices of other fuels brought life back into what had previously been a dying industry. In 1980 coal's share of the total U.S. consumption of energy had risen to over 20 percent. It has become national policy and the goal of many in the world community for coal to become the primary fuel to carry the transition into a time when truly renewable energy sources should be available.[2]

For coal to fulfill its role as a major energy source it has to be available where it is needed. Like any commodity, coal's value is determined by its availability to its users. Since little coal is actually consumed where it is mined, it is the transportation system that provides this availability, thus playing a vital role in determining the extent to which coal can meet its future needs.

This report is intended as an aid to understanding the role of the coal transportation system, particularly as it relates to the southern region of the United States. To accomplish this task the report looks first at the locational characteristics of coal as a commodity: where it comes from, where it goes (by type of user and geographic area), and how it moves. The major legal, social and environmental aspects of the various methods of coal transportation are then reviewed. Finally, to provide the basis for speculation about future coal-related transportation developments in the South, some recent major coal policies and trends are analyzed. The implications that these policies and trends are likely to have on the coal transportation system in the southern region are then considered.

II.

THE LOCATIONAL CHARACTERISTICS OF COAL

As an essential step in understanding the coal transportation system in the southern region, this section examines the major locational characteristics of the commodity coal. First is a survey of the states and the coal-producing districts in the region to determine specifically where southern coal comes from. Next comes a look at where it goes. This part involves looking first at the consumption of southern coal by each end-use sector, then making the same observation by geographic region. Finally, the various methods by which coal is moved are described, as well as the relative proportion carried by each method.

Where It Comes From

In 1978 the ten coal-producing states of the southern region of the United States produced 313,254,000 short tons of coal.[3] This was 47 percent of the total U.S. production for that year, 665,127,000 short tons. Kentucky, with 135,689,000 tons, was the largest producer, with over 43 percent of the total for the region and over 20 percent of the U.S. total. West Virginia was second in the region and in the U.S., with 85,314,000 tons, followed by Virginia, with 31,946,000 tons, Alabama, with 20,553,000 tons, and Texas, with 20,020,000 tons. These five states represent 94 percent of the total production for the southern region. The other coal-producing states and their respective regional proportions are: Tennessee (3.25%), Oklahoma (1.9%), Maryland (1.0%), Arkansas (.2%), and Georgia (less than .1%).

Coal production in the southern region tends to be characterized by a large number of smaller, less productive underground mines. For example, with less than half of the U.S. production, the southern region has 75% of the nation's mines and 55% of the miners.[4] Fifty-two percent of the mines in the region are underground; the U.S. average is 43%. At the same time, 81% of the miners in the region work in underground mines. The national average is 66%. Because of the difficulties of underground mining, workers in that activity are only about 1/3 as productive as surface miners, averaging 8 1/2 tons a day per miner, against 26 tons for surface miners.[5]

The physical characteristics of the coal found in the southern region are those generally considered desirable by the major users. Southern coal tends to have a high heating value, measured in British thermal units per pound. In parts of the region, particularly West Virginia, Virginia and eastern Kentucky, the coal is also of low sulphur content. Sulphur dioxide has been identified as the major pollutant given off by coal burning and has been severely restricted by federal environmental regulations, thus requiring expensive cleanup when the coal is burned. Since this cleanup cost is closely related to the sulphur content of the coal, low sulphur, high btu coal brings a premium in the marketplace. For the southern region as a whole, the average price per ton in 1978 was $26.35, compared to the national average of $21.78.[6] Table 1 shows the production and average price of coal produced in the states of the southern region and U.S. total for 1978.

TABLE 1

PRODUCTION AND VALUE OF BITUMINOUS COAL AND LIGNITE, 1978

	Production (thousand short tons)			Value ($ per ton)		
	Underground	Surface	Total[1]	Underground	Surface	Total
Alabama	6,169	14,383	20,553	39.22	27.94	31.33
Arkansas	3	516	519	W	W	39.86
Georgia	-	113	113	-	52.23	52.23
Kentucky	59,484	76,204	135,689	27.03	21.38	23.86
Maryland	382	2,616	2,998	24.16	18.70	19.40
Oklahoma	2	6,068	6,070	44.40[e]	21.41	21.42
Tennessee	4,150	5,882	10,032	23.30	23.14	23.21
Texas	-	20,020	20,020	-	6.04	6.04
Virginia	21,511	10,435	31,946	33.05	25.24	30.50
West Virginia	65,216	20,099	85,314	35.45	25.70	33.15
SOUTHERN REGION	156,917	156,336	313,253	31.70	20.19	26.35
U.S. Total	242,177	422,950	665,127	$30.94	$16.53	$21.78

[1]Sum of components may not equal total due to independent rounding.

W= Withheld to avoid disclosing individual company data.

[e]Estimated

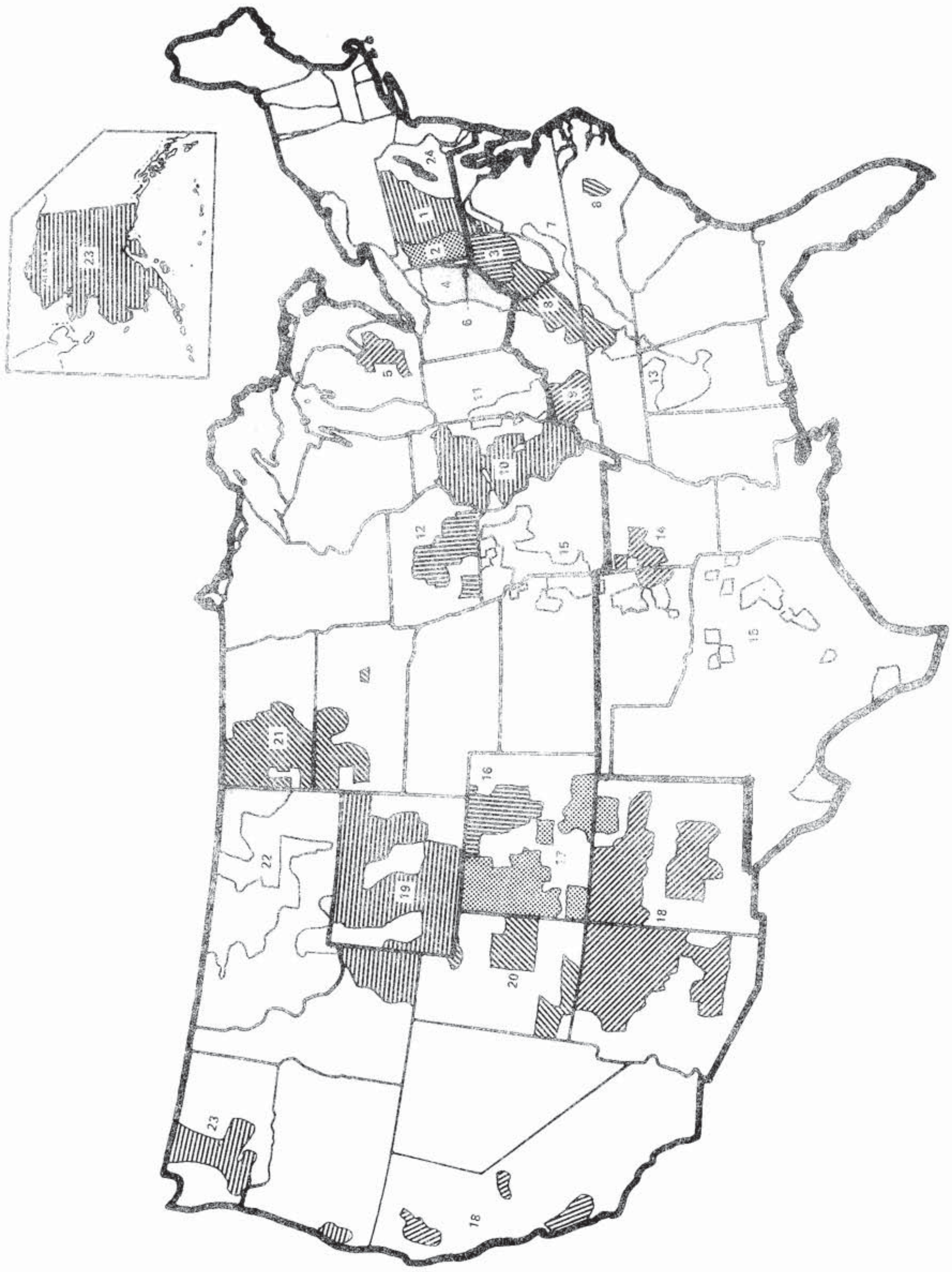
Source: U.S. Department of Energy, Energy Information Administration, WEEKLY COAL REPORT, No. 126, February 29, 1980; Author's calculations.

Figure 1

Coal Consumption by End-Use Sector
Million Short Tons

Figure 2

Coal Producing Disricts[a]



[a] The Bituminous and Subbituminous Coal and Lignite Producing Districts (1-23) were defined in the Bituminous Coal Act of 1937 and Amendments.

The districts were originally established to aid in formulating minimum prices of bituminous and subbituminous coal and lignite. Because much statistical information was compiled in terms of these districts, their use for statistical purposes has continued since the abandonment of that legislation in 1943.

District 24 is the anthracite producing district in Pennsylvania.

Table 2

Coal Consumption by End-Use Sector

Million Short Tons

Year	Electric Utilities	Industrial			Transportation	Residential and Commercial	Total
		Coke Plants	Other Industry and Miscellaneous [1]	Total			
1950	91.9	104.0	120.6	224.6	63.0	114.6	494.1
1951	105.8	113.7	128.7	242.4	56.2	101.5	505.9
1952	107.1	97.8	117.1	214.9	39.8	92.3	454.1
1953	115.9	113.1	117.0	230.1	29.6	79.2	454.8
1954	118.4	85.6	98.2	183.9	18.6	69.1	389.9
1955	143.8	107.7	110.1	217.8	17.0	68.4	447.0
1956	158.3	106.3	114.3	220.6	13.8	64.2	456.9
1957	160.8	108.4	106.5	214.9	9.8	49.0	434.5
1958	155.7	76.8	100.5	177.4	4.7	47.9	385.7
1959	168.4	79.6	92.7	172.3	3.6	40.8	385.1
1960	176.6	81.4	96.0	177.4	3.0	40.9	398.0
1961	182.1	74.2	95.9	170.1	0.8	37.3	390.3
1962	193.2	74.7	97.1	171.7	0.7	36.5	402.2
1963	211.3	78.1	101.9	180.0	0.7	31.5	423.5
1964	225.4	89.2	103.1	192.4	0.7	27.2	445.7
1965	244.8	95.3	105.6	200.8	0.7	25.7	472.0
1966	266.5	96.4	108.7	205.1	0.6	25.6	497.7
1967	274.2	92.8	101.8	194.6	0.5	22.1	491.4
1968	297.8	91.3	100.4	191.6	0.4	20.0	509.8
1969	310.6	93.4	93.1	186.6	0.3	18.9	516.4
1970	320.2	96.5	90.2	186.6	0.3	16.1	523.2
1971	327.3	83.2	75.6	158.9	0.2	15.2	501.6
1972	351.8	87.7	72.9	160.6	0.2	11.7	524.3
1973	389.2	94.1	68.0	162.1	0.1	11.1	562.6
1974	391.8	90.2	64.9	155.1	0.1	11.4	558.4
1975	406.0	83.6	63.6	147.2	(2)	9.4	562.6
1976	448.4	84.7	61.8	146.5	(2)	8.9	603.8
1977	477.1	77.7	61.5	139.2	(2)	9.0	625.3
1978	481.2	71.4	63.1	134.5	(2)	9.5	625.2
1979	527.1	77.4	67.7	145.1	(2)	8.4	680.5
1980[3]	569.2	66.7	62.5	129.2	(2)	7.6	705.9

[1] See Explanatory Notes 1 and 7.
[2] Less than 0.05 million short tons.
[3] Preliminary.
Note: Sum of components may not equal total due to independent rounding.
Note: After 1977, small amounts of bituminous coal and lignite consumed by the Transportation Sector are included in the Other Industry and Miscellaneous category.
Source: Bituminous Coal and Lignite: • 1950 through 1975 -- Bureau of Mines, *Minerals Yearbook*, "Bituminous Coal and Lignite" chapter; Federal Power Commission, Form 4, "Monthly Power Plant Report." • 1976 through 1980 -- Energy Information Administration, Energy Data Reports, *Weekly Coal Report*. Anthracite: • 1950 through 1975 — Bureau of Mines, *Minerals Yearbook*, "Coal —Pennsylvania Anthracite" chapter; Federal Power Commission, Form 4, "Monthly Power Plant Report." • 1976 through 1978 — Energy Information Administration, Energy Data Reports, *Coal-- Pennsylvania Anthracite, Annual*. • 1979 and 1980 — Energy Information Administration, Energy Data Reports, *Weekly Coal Report*.

Where It Goes, by Type of User

Since World War II, coal produced in the U.S. has gone almost exclusively to five end-use sectors: electric utilities, industrial, transportation, residential and commercial, and export. The proportion going to each of these sectors has changed radically since that time, however. Table 2 shows the tonnage used by each sector for the years 1950 to 1980. This distribution is illustrated graphically in Figure 1.

Electric Utilities

Electric utilities, which in 1950 represented less than 18 percent of the total coal consumption, now account for over 71 percent. With prices steadily rising and the likelihood of shortages in the primary non-coal electric power generating fuels, petroleum and natural gas, as well as federal laws encouraging utilities to shift from these fuels to coal, coal's proportion is likely to increase over the next few years.

Industrial Coal

Industrial coal use accounted for 43 percent of the U.S. consumption in 1950 but had fallen to 16 percent by 1980. This classification consists primarily of coking coal (coal that is carbonized for use in steel production) and coal that is used directly by industry for heat, power, and conversion to other energy forms. Part of the decline in this sector is attributable to a diminished demand for American steel products and a general shift to more convenient oil and natural gas for industrial uses. Market forces may reverse both of these trends if the U.S. auto industry, the major steel user, is able to regain a significant part of its lost market share and as the convenience of relatively clean easy-to-use oil and gas becomes overshadowed by their comparatively high costs.

Transportation, Residential, Commercial

Transportation and residential and commercial uses of coal have all fallen to insignificant levels. Transportation, mainly railroads, had 11 percent of the total consumption in 1950, but dropped to almost nothing in 1980. Residential and commercial use, which accounted for 20 percent of the total in 1950, was less than 1 percent in 1980. Neither of these sectors is expected to contribute significantly to the future demand for coal regionally or nationally.

Exports

The final sector of demand for coal is exports. The share of coal going for export purposes has doubled, from 6 percent in 1950 to 12 percent currently. While the 40 percent jump in coal exports for 1980 is considered something of a temporary aberration, the long-term outlook for this sector appears quite bright, as other nations shift toward greater coal use and as this country emerges as one of the more reliable suppliers of the product.

Table 3

Domestic Distribution of Coal Produced in the U.S. by Coal Producing District, Consumer Category and Method of Transportation: January-September 1980 (Thousand Short Tons)

Consumer Category / Method of Transportation	Total	Coal Producing District 3 & 6	7	8	9	13	14	15	Region Total of U. S. (42.1%)	Per Cent of U.S.
U.S. Total	539,624	25,496	11,427	113,254	30,279	16,110	679	29,784	227,029	(100.0%)
Electric Utilities Total	439,953	22,073	2,058	82,148	29,296	11,285	160	27,583	174,603	(87.2%)
Rail	252,796	7,911	1,275	61,764	9,916	3,761	72	18,377		
River	73,700	8,095	402	14,236	13,709	2,264	88	98		
Great Lakes	8,758	64	4	3,389	806	–	–	–		
Tidewater Piers and Coastal Ports	1,862	823	377	362	–	8	–	–		
Truck	56,450	1,170	–	2,398	4,865	4,173	–	7,310		
Tramway, Conveyor, and Slurry Pipeline	46,386	4,008	–	–	–	1,079	–	1,797		
Coke Plants, Total	49,506	1,360	8,666	17,066	–	3,139	353	40	30,624	(15.3%)
Rail	29,993	1,028	4,851	11,309	–	1,675	180	40		
River	12,117	–	2,088	3,759	–	–	43	–		
Great Lakes	2,585	37	930	1,584	–	–	–	–		
Tidewater Piers and Coastal Ports	2,192	295	289	355	–	28	–	–		
Truck	2,111	1	(*)	58	–	1,436	130	–		
Tramway, Conveyor, and Slurry Pipeline	508	–	508	–	–	–	–	–		
Other Industrial, Total	44,723	1,983	649	12,542	825	1,450	154	2,076	19,679	(9.8%)
Rail	25,128	1,421	443	9,536	438	428	92	966		
River	3,234	23	77	1,294	84	126	–	117		
Great Lakes	2,160	412	79	811	–	–	–	–		
Tidewater Piers and Coastal Ports	56	–	–	(*)	–	30	–	–		
Truck	12,361	126	11	896	300	849	62	893		
Tramway, Conveyor, and Slurry Pipeline	1,612	–	–	–	–	–	–	–		
Residential/Commercial, Total	4,384	69	25	1,122	123	235	12	79	1,665	(0.8%)
Rail	1,505	48	10	795	4	5	–	13		
River	31	–	–	15	1	–	–	4		
Great Lakes	107	8	1	63	–	–	–	–		
Truck	2,645	8	–	207	118	231	12	61		
Transportation	87	3	16	46	4	–	–	–	69	(*)
Unknown/No Revealable	972	8	13	329	31	–	1	7	389	(*)

(*) Value is less than 500 Short Tons.

SOURCE: Form EIA-6, Coal Distribution Report, Energy Information Administration, U.S. Department of Energy.

Table 4

Coal Transportation by District
January-September 1980
(In Tons)

		3 & 6	7	8	9	13	14	15	
Total		25,496	11,407	113,254	30,279	16,110	679	29,784	227,029
Rail *	A	7,911	1,275	61,764	9,916	3,761	72	18,377	
	* B	1,028	4,851	11,308	—	1,675	180	40	
	* C	1,421	443	9,536	438	428	92	966	
	* D	48	10	795	4	5	—	13	
		10,408	6,579	83,404	10,358	5,869	344	19,396	136,358 (60%)
River	A	8,095	402	14,236	13,709	2,264	88	98	
	B	—	2,088	3,759	—	—	43	—	
	C	23	77	1,294	84	126	—	217	
	D	—	—	15	1	—	—	4	
		8,118	2,567	19,304	13,794	2,390	131	319	46,623 (21%)
Great Lakes	A	64	4	3,389	806	—	—	—	
	B	37	930	1,584	—	—	—	—	
	C	412	79	811	—	—	—	—	
	D	8	1	63	—	—	—	—	
		521	1,014	5,847	806	0	0	0	8,188 (4%)
Tidewater Piers and Coastal Ports	A	823	377	362	—	8	—	—	
	B	295	289	355	—	28	—	—	
	C	—	—	—	—	30	—	—	
		1,118	666	717	0	66	0	0	2,567 (1%)
Truck	A	1,170	—	2,398	4,865	4,173	—	7,310	
	B	1	—	58	—	1,436	130	—	
	C	126	11	896	300	849	62	893	
	D	8	—	207	118	231	12	61	
		1,305	11	3,559	5,283	6,689	204	8,264	25,315 (11%)
Tramway, Conveyor and Slurry Pipeline	A	4,008	508	—	—	1,079	—	1,797	
	B	—	—	—	—	—	—	—	
	C	—	—	—	—	—	—	—	
		4,008	508	0	0	1,079	0	1,797	7,392 (3%)

* Where A is Electric Utilities, B is Coke Plants, C is Other Industrial, and D is Residential.

Where It Goes, by Geographic Area

Figure 2 shows the coal-producing districts in the United States, as defined in the Bituminous Coal Act of 1937 and as currently defined by the U.S. Department of Energy. Seven of the twenty-three districts lie exclusively within the southern region. Since only about 20 percent of the 15th District's production lies outside the region, it is considered part of the region for purposes of this report. Using these districts as a basis, Table 3 shows the domestic distribution of coal produced in the U.S. from January to September of 1980. This distribution is broken first into consumer categories and then further into methods of transportation to each type of consumer.

The eight districts of the southern region produced 42.1 percent of the nation's domestically distributed coal over that nine-month time period. Of the 227,028,000 tons coming from the region, 87.2 percent went to electric utilities. Almost half of this utility coal total comes from District 8, which encompasses the east Kentucky, western West Virginia coal belt. Fifteen and three tenths percent went to coke plants. This coking coal is high grade, premium price coal, coming predominantly from the east Kentucky and western West Virginia area. The "Other Industries" classification used 9.8 percent of the region's coal; this category was also dominated by District 8 production. The remaining major customer category, "Residential/Commercial," consumed less than one percent of the region's total, and the categories of "Transportation" and "Unknown/Not Recoverable" were too small to calculate.

Table 4 rearranges the data of Table 3 to highlight the transportation modes involved. This table shows that, of the total amount produced in the southern region and consumed in the United States, 60.4 percent was delivered by rail and 20.6 percent was delivered by river-borne transportation. Trucks delivered only half as much as river transportation, with 11.2 percent of the region's total. Interestingly, some southern coal, 3.6 percent, found its way to its U. S. consumer by way of the Great Lakes. Tramways, conveyors, and slurry pipelines carried a similar proportion, 3.3 percent. While the Great Lakes method represents probably the longest route domestic southern coal ever takes, tramways, conveyors and pipelines are generally the shortest.

This U.S. Department of Energy information appears to be the best available on overall domestic coal movement. The reader should be aware, however, that the data does have certain limitations, primarily with regard to definitions. From a state and regional perspective, the most serious of these shortcomings lies in the way in which information on trucks is derived. By the DOE definitions (see Appendix A) coal is considered to have been shipped by truck "only when the coal is shipped directly to the consumer by truck." Coal is considered to have been hauled by rail even if it "is hauled to or away from a rail siding by truck." Thus while these figures are no doubt an accurate depiction of how coal is delivered from the consumer's standpoint and are probably a fair description of the overall methods of transportation, they do not adquately reflect the situation from the producer's end. For example, District 8, which includes east Kentucky, is shown as having 74 percent of its coal delivered by rail. The Kentucky Department of Mines and Minerals statistics show 79 percent of east Kentucky coal transported from the mine by truck and only 21 percent by rail.[7] These figures are not contradictory, since

they are measuring different points in the transportation system, but they do point out the care required in using either of these data sets. While the DOE figures understate the role of trucks in coal movement, the Mines and Minerals numbers would overstate trucking's contribution, if their proportions were taken as representative of overall coal movement.

The Methods of Movement

Given the vast and diverse area covered by the southern region, it is doubtful that any data could provide a totally accurate yet comprehensible description of coal movement that would fairly depict the various parts of the region. Nonetheless, there are some observations that can be made regarding the major modes of coal movement that seem to have universal applicability. For example, barges appear to be the mode of choice when they are available. A towboat with a 6,000 horsepower engine can propel a brace of barges carrying as much as 50,000 tons of cargo. A diesel locomotive with the same horsepower can efficiently handle a "unit train" - a train of 100 cars loaded with 100 tons of coal each, or a total of 10,000 tons.[8]

This comparative efficiency has resulted in generally lower shipping rates for barges, even over fairly short distances. Since barges require a navigable waterway, however, and since coalfields do not always lie on or near such a waterway, their use is not always feasible.

Rails are much more flexible than barges and are much more efficient than trucks. Rail lines serve most of the major coalfields in the southern region. The capital stock of American railroads has been eroding steadily for decades, however. Many stretches of track are so hazardous that speed limits have had to be drastically reduced, and a shortage of railcars has presented the coal industry a chronic problem during the mid 70s.[9]

A major change for the nation's rails occurred recently with the passage of the Staggers Act of 1980. This act was essentially intended to deregulate the rail industry. For coal shippers this legislation means that railbeds can now be upgraded, service should improve, and more cars should be available. These improvements will, however, be at the cost of increased shipping rates.

The magnitude of the increase will vary greatly, depending on the shipper's size and location, and on the availability of competition from other modes. It is generally conceded that small and out-of-the-way shippers who have traditionally been protected under Interstate Commerce Commission regulations will face higher costs and possible denial of service, while large shippers, who can drive a harder bargain, will be harmed less and may even see a rate decrease.

At a recent meeting of the Kentucky Coal Conference it was demonstrated that many shippers hauling coal to the Gulf area have found that the cost advantage of hauling by barge has disappeared.[10] It is now often less expensive to ship all the way to New Orleans by rail. The change is attributed to the deregulation afforded by the Staggers Act. The overall impacts of the Act are only beginning to be seen.

Trucks play a vital role in the movement of coal and are seemingly irreplaceable. As mentioned earlier, there is good reason to believe that the U.S. Department of Energy figures understate trucking's share of the coal

movement system. This is only part of the underemphasis resulting from strict numerical comparisons, however; there is simply no substitute for the service that trucks provide, even though it be movement of coal some fairly short distance from the mine site to a consumer or another transportation mode. Few new mines justify the expense of a new rail spur and fewer are fortunate enough to be located directly on a waterway. Without trucks, only the largest mines would be served by any form of transportation. Trucks offer the ultimate in flexibility, both in terms of where they can pick up and where they can deliver.

Unfortunately, trucks are in a class by themselves when it comes to the costs they impose on the government sectors and on others. As will be discussed in the following section, when overweight coal trucks are used on roads that were never intended to carry such loads, they cause rapid, sometimes instant, deterioration of the highway surface. This overuse is common in many parts of the South. When it occurs public expenditures for highway repair and maintenance are greatly increased. A recent study in Kentucky found that the state highway costs associated with coal hauling may exceed the total coal severance tax collected there.[11]

Another transportation system that may have a significant role to play in the future movement of coal is one that currently does not exist in the southern region, the coal slurry pipeline. Pipelines have the potential to deliver great quantities of coal at comparatively low rates. The pipeline of particular interest to the southeastern U.S. is one proposed by Continental Resources Company of Winter Park, Florida. This company anticipates building a $5 billion 1500-mile pipeline starting from points in southern Illinois and West Virginia.[12] It would run in the shape of a Y through Kentucky and Tennessee, merging in northern Georgia, then continuing to Florida. Since there are extensive social, legal and environmental issues involved with the concept of a coal slurry pipeline, and since these issues are the subject of much current debate, the following section addressing issues of the specific modes of transportation will begin with and emphasize coal slurry pipelines.

III.

SOCIAL, ENVIRONMENTAL AND LEGAL CONSIDERATIONS

Coal Slurry Pipelines - Environmental and Social Effects

The use of coal slurry pipelines is probably the most controversial method of coal transportation. Coal slurry is a combination of ground coal and liquid, usually water. After the mixture is transported through a pipeline, the coal can be taken out by settling, filtration, or centrifuge. The effects of this method are the subject of a heated debate, partly because it has not yet been used on a large scale. Some people see pipelines as the most efficient way to move coal, especially over long distances, and maintain that the process has few long-term harmful effects. Others predict serious problems, particularly in the western United States. Fueling the debate is the knowledge that pipelines have the potential to cause major changes within the coal transportation industry, which leads to opposition from established interests, including railroads.

While there are at least seven major coal slurry pipelines planned for the United States, only two have been constructed. One is in Ohio: finished in 1957, it was used successfully until 1963 and then shut down because it could not compete with unit trains. The only pipeline now in use is the Black Mesa, connecting strip mining operations in northern Arizona to a generating plant in Nevada. Despite occasional shutdowns, it is reportedly operating successfully.[13]

Arguments Against Coal Slurry Development

One of the primary arguments against pipelines concerns the amount of water they use. To carry the coal, many gallons must be pumped out of the ground or from nearby bodies of water. Particularly in dry areas, slurry lines must compete with other users for a badly needed resource. Some Westerners are concerned that coal slurry will deprive them of the water they need to live and work. A recent study by the University of Wyoming shows that one proposed pipeline, from Wyoming to Arkansas, would use enough to lower the water table by 250 feet in twenty years.[14] This demand would threaten the water supply for portions of the state.

Another argument against slurry development is that it will harm railroad interests. The U. S. Office of Technology Assessment (OTA) estimates that if the pipelines now being planned are completed, railroads will experience a net profit loss of $680 million by the year 2000.[15] Rail operators fear that slurry pipelines will take away their most valuable business. As common carriers, they are required by law to handle coal from all producers, large and small. Pipelines may not be subject to this legal limitation; railroad management believes pipeline companies will be allowed to select their customers, leaving only small, out-of-the-way production for the rails to handle.

Train operators claim that setting up a new technology in direct competition with railroads would violate the established national policy toward railroads. The U. S. Congress enacted the Railroad Revitalization and Regula-

tory Reform Act of 1976 to assist struggling railroads. Mr. C. J. Chamberlain, chairman of the Railway Labor Executives' Association, had this to say in 1978:

> It seems to us contradictory...to provide a type of competition which would skim the cream from the traffic carried by the railroads for the benefit of private companies and very few members of the public, thereby further weakening the railroads and very probably necessitating greater amounts of Congressional aid to the railroads in the forms of direct monetary grants and loan guarantees.[16]

Another argument is that slurry pipelines can harm the environment in ways not associated with drying up the chemical interaction between coal and the liquid with which it is mixed. Because coal is finely ground before becoming part of the slurry, a great deal of its surface area comes into contact with liquid while it is running through the pipes (one ton of coal in the Black Mesa Pipeline exposes 55 acres of surface area to water). Chemical reactions can be dangerous, the OTA warns, in the event of: "(1) a slurry spill or possible rupture; (2) slurry dewatering process and water rinse or waste water disposal; and (3) alteration of combustion characteristics of the end-product coal."[17]

There are other adverse effects on the environment which inevitably accompany pipelines. Among them are noise (primarily during construction), loss of vegetation, erosion, air pollution, and disruption of animal communities. The major threat of environmental disruption during slurry operation is the possibility of an accidental spill. This could occur in several ways: the pipeline might rupture from excessive pressure, it could break when struck by digging equipment, or it might be washed out during a flood.[18]

Arguments In Favor Of Coal Slurry

Advocates claim that coal slurry has significant social and economic advantages over other methods of transportation. The costs of maintaining a pipeline are relatively stable, regardless of the amount of coal being run through it. Once the line is built, the amount which must be spent on upkeep is low. The initial costs - planning and construction - represent a large part of the price. Since these occur only once, early in the process, they are relatively inflation-free. Railroads, on the other hand, are expensive to run and have a cost structure which is heavily weighted by such inflationary factors as labor, fuel, and track upkeep. The National Energy Transportation Study says this about the benefits of pipelines:

> Under appropriate conditions, coal slurry pipelines can be the most economical and environmentally preferable means of transporting coal. Coal slurry pipelines may be an economic form of transport where large volumes of coal need to be transported over a long distance from one mine to a single user and where a direct rail or barge route does not already exist.[19]

The President's Commission on Coal has listed three major advantages to coal slurry: (1) the underground routes do not disrupt communities; (2) although pipeline construction requires a large capital investment, operating costs - which are subject to inflation - are low; and (3) on a cost-per-ton

basis, slurry pipelines are highly competitive with railroads.[20]

Supporters maintain that pipelines have been proven to work and should be given an opportunity to compete in an open market: railroads and other interests should not be allowed to hold back pipeline development artificially. Some even feel that pipeline development is needed to break a monopoly on coal transportation. Only by allowing price competition will we reduce utility and energy rates, they say. In the words of George W. Oprea, executive vice president of Houston Lighting and Power Company:

> Coal slurry lines would provide an alternative form of transportation that at the very least would create a competitive incentive for the establishment of more realistic rates by railroads. We are convinced from our own experience that such an incentive is urgently needed. We are equally convinced that without reasonable transportation rates, the national policy of development and utilizing the country's vast coal resources will be seriously jeopardized.[21]

Claims of adverse effects on the environment are exaggerated, slurry developers believe. In particular, they maintain that forecasts of water shortages are not realistic. In the West, federal and state legislation will provide adequate water protection; currently proposed federal legislation purportedly gives states an absolute veto over any plan to use water. As for the East, water supplies will not be seriously threatened, because the required amounts represent a small fraction of the water available. The Ohio River would be the main water source for the proposed Y-shaped pipeline which would run through the entire Southeast. Estimates are that at least three hundred gallons of water - 40 cubic feet - will have to be pumped into that pipeline every second. Developers argue that while this seems like a huge amount, the average water flow of the Ohio River is 77,000 cubic feet a second.[22] The pipeline, they say, would hardly produce a noticeable loss of water.

The OTA has projected the effects of slurry lines on water supplies in various regions of the country. Its study sets up imaginary pipelines where "the general location of the source of the routes is plausible because of the abundance of coal at the selected locations."[23] For the Southeast, the hypothetical pipeline has its source near Tracy City, Tennessee, on a divide straddling three drainage systems. The water supply would come out of the Tennessee River (because "ground water supply is not a feasible alternative in southeast Tennessee"). The OTA concludes:

> Given the large flows in the Tennessee River...withdrawal of [the necessary water] would not be expected to have any significant impact upon stream water quality. The primary current consumptive uses of water in the Tracy City area are municipal and do not present apparent conflict with future alternative water uses, including pipelines.[24]

Pipeline supporters also address the environmental problems of noise, loss of vegetation, erosion, and disruption of animal communities. Most of these effects would be temporary, they say, and could be minimized over the long term by careful planning and reclamation. Particularly in the Southeast, such difficulties can probably be avoided by choosing the best routes and by building during those times of the year which would be the least sensitive biologically.

Air pollution would probably not be a major problem, according to the OTA:

> Pipeline operations will have an indirect and relatively minor impact upon air quality if the electricity required to run pumps, slurry preparation equipment, and dewatering facilities is generated by combustion of fossil fuels.[25]

The Y-shaped pipeline proposed for the Southeast would bring many benefits to this region, according to its developers. The estimated cost of building the line is $3 billion in 1981 dollars, which may translate into $5 billion by the time it is built, but it would be able to carry 50 million tons of coal a year, primarily to utilities. Promoters also expect a market for 10-to-15 million tons of exported coal slurry.[26] According to a study by the National Economic Research Associates, such a pipeline would produce the following benefits:

> The potential increase in domestic coal use resulting from pipeline transport of coal to Georgia and Florida would be 17.3 million tons a year. Total savings of petroleum would be 62.6 million barrels a year in 1990. Total savings to utility customers through the utilities' use of pipelined coal in Georgia and Florida based on savings in transportation costs would be $118.7 million in 1990, $380.7 to $677.9 million in 1995, and $828.7 to $1,799.3 million in 2000. Increased coal use from pipeline transportation to Georgia and Florida would mean the employment of 5,200 additional mine workers in Kentucky, West Virginia, Indiana and Illinois. Reduction in oil imports would means a savings in our national oil import bill of $678 million in 1995 and $723 million in 2000.[27]

Coal Slurry Pipelines - Legal Considerations

In order for long pipelines to be built, eminent domain legislation is almost a necessity. When it exercises its eminent domain power, the government takes property needed for a public purpose and pays just compensation to the owner. States can grant this power within their borders, but a pipeline crossing several states is probably only practicable if a federal eminent domain law is passed.

Without such legislation, individual landowners can block the path of a pipeline by refusing to grant rights-of-way; private interests opposed to slurry can make it nearly impossible to find a route. For example, no pipeline could go far without crossing rail lines, and railroad management makes no secret of its opposition to pipelines. In the Southeast, railroads usually own the land upon which the tracks run; they would thus have no legal problem if they wished to block a pipeline.

Relying on individual states to enact eminent domain legislation would be a slow and uncertain approach. Private interests might be strong enough to block legislative action in some states; one balky legislature can prevent construction of a large project. Some developers have stated that they will not proceed unless federal eminent domain is granted.

According to the OTA, eminent domain legislation in most states would have three elements: (1) a license or certificate of public necessity would

need to be granted by a state agency; (2) the pipeline would be designated a common carrier or public utility; and (3) the pipeline would be subject to such state regulations as would not burden interstate commerce unduly or interfere with federal regulations.[28]

In order to exercise eminent domain power, a state must show that it is performing a necessary public purpose. There would be no problem with such a demonstration in a state intended as the destination of a pipeline: the advantages would be clear. However, states which would merely allow pipelines to run across their land, without deriving any other benefit, might not be in a position to claim that the public will receive enough advantage to justify the taking of the land.[29]

Some state legislatures have already acted on the pipeline issue. States which have granted eminent domain to coal slurry include Florida, Louisiana, North Carolina, North Dakota, Ohio, Oklahoma, Texas, Utah and West Virginia. Bans on eminent domain have passed in Montana and Virginia.[30]

Federal eminent domain legislation would supersede state laws and clear the way for pipeline development throughout the nation. One limited grant of this power has already passed the U. S. Congress: P.L. 94-579, enacted in 1974, provides eminent domain for coal slurry pipelines which cross federally-owned lands.[31] Wider grants of the power have been debated often, and legislation has been proposed in each of the last several sessions of Congress. These federal proposals generally would grant eminent domain upon the attainment of a certificate of public convenience and necessity, and would then provide that the pipeline be regulated as a common carrier.

If federal eminent domain power were approved, it might mean that coal slurry pipelines would have a significant economic advantage over railroads, one not entirely based on any inherent superiority. Certain differences in the regulatory framework which would apply to the two systems might give unnatural advantages to coal slurry.

> These advantages would stem from the differences between regulated tariffs and cost of service, the ability of pipelines to serve selected customers, and the prohibition of long-term contracts between railroads and their shippers.[32]

Coal Trucks

Trucks remain one of the most popular forms of coal transportation, though they are one of the least efficient. Their continued heavy use is due largely to the small initial cost of purchase and to their availability and flexibility. Many small mines, especially in rough terrain, are hard to reach without trucks. Many small coal operators have no other way to move their coal. Within a short distance there may be a tipple or some other access to transportation, owned by someone else; but usually the initial movement must be by truck. Because of this and because of their convenience, trucks will continue to be widely used.

Of all modes of coal transportation in Kentucky, however, trucks are the most costly. At distances of under 150 miles - the sort of run for which most trucks are used - truck transportation costs much more per ton-mile than other methods.[33]

Coal trucks also impose burdens on the residents of the area in which they are driven. Overloaded trucks seriously damage highway surfaces, making travel dangerous for all vehicles. Bridges can be strained so severely that they may collapse unexpectedly, even under light traffic. Dust from crumbling road surfaces pollutes the air and reduces visibility for drivers. Heavy trucks can produce very high noise levels.

To control the amount of damage caused by coal trucks, there are a number of state and federal restrictions on such factors as size and weight. These limits are the subject of much debate. Requirements concerning registration and taxation vary from state to state, leading to charges of unfairness and favoritism.

Coal truck operators have a number of serious complaints. In Kentucky, their criticisms concern everything from weighing procedures to uneven enforcement. Faced with intense competition among themselves and with limits on the amounts they are allowed to carry, many truck drivers find it difficult to survive in the industry. To make a decent living, they claim, they are forced into violating the law and hauling overweight.

Taxation is also a subject of complaint among Kentucky coal haulers. Independent truckers feel they are mistreated by a provision which adds a surcharge to the normal fuel tax if a vehicle is classified as "heavy equipment." They complain that out-of-state trucks operating within Kentucky are given an unfair advantage because they can avoid paying the full amount of the state's usage tax. Theoretically, trucks apportion their taxes according to the number of miles traveled in each state. In practice, truckers say, clever and unscrupulous drivers can avoid paying their fair share by carefully choosing the states in which they register and operate.

Unevenness of regulation and enforcement among states is the cause of several complaints. Kentucky, for instance, does not follow the surrounding states' practice of allowing registration to follow the owner if his truck is wrecked or traded. Instead, Kentucky registration stays with the truck and a fresh set of fees must be paid whenever a new truck is acquired. Another problem is an alleged lack of uniformity in policing the laws. As trucks cross city, county and state borders they are subjected to a bewildering variety of limitations.

These problems might be alleviated if states cooperated to standardize the regulation of the coal trucking industry. With more uniform treatment, drivers say, they would feel less mistreated and coal transportation would become more efficient. Such a change could eventually lower coal haul rates and protect the roads.

Railroads

Railroads are dependable and efficient, and they use relatively little energy. Especially on long runs, they are considerably thriftier than trucks:

> The low frictions of steel wheel on steel rail and low wind resistance of a long train of cars gliding through its own column of reduced pressure makes railroads at least four times more energy-efficient than are trucks for runs of over 300 miles.[34]

Increased use of unit trains and high-speed loading techniques have significantly improved rail transport. There are, however, social and environmental drawbacks to the use of trains. They create noise problems, block automobile traffic, present the danger of accidents at crossings, and interfere with movement of animals and people on farms and rangelands.[35]

The effects of rail construction are as severe as those caused by pipeline installation, and they may be longer-lasting. Instead of being buried, rails remain on the surface of the earth: their effects do not disappear. Farmlands and grazing areas are subject to interference; disruption of biological communities can occur. Fortunately, however, new rails do not always have to be built to handle increases in traffic. Many of the existing tracks can accommodate additional cars.

The impacts of the day-to-day operation of railroads are also fairly well known. There is some air pollution associated with the running of trains. "Diesel-electric locomotives emit carbon monoxide (C), hydrocarbons (HCs), nitrogen oxides (chiefly nitric oxide (N)), particulates, and other pollutants during line-haul operations."[36] However, the effect on air quality is not particularly severe; some other methods of coal transportation create more pollution. Railroads do increase the amount of dust in the air. Dust emissions may occur during loading or unloading, or when coal dust blows from hopper cars, or when air currents are stirred up along the right-of-way. The OTA study mentions these facts but admits a lack of evidence to show that these effects are very harmful. "In summary," it states, "western experience and limited scientific evidence indicate that fugitive dust emissions from unit train operations are likely to have negligible impact on air quality."[37] Railroads' effect on plants and animals has also been noted. Existing plant communities are destroyed near tracks. As for animals:

> Creation of a visible discordant strip may affect wildlife behavior patterns, as some species are hesitant to enter a region which has been disturbed. In addition, wildlife movements may further be affected by the additional noise and activity of passing trains, and the establishment of fences to protect livestock from accidental collision.[38]

The effects of increased railroad use on the Southeast are by no means all negative. The expansion of coal markets can speed economic development. Larger volumes of coal moving by train could bring a reduction in transportation rates, which would affect the entire industry. Environmental problems can largely be countered by careful planning and by continued use of existing rail lines.

Barges and Towboats

Of all modes of coal transportation currently in use, barges and towboats are the most energy-efficient.[39] The environmental effects of water traffic are almost negligible. Towboats produce fewer pollutants per ton-mile than do most other surface vehicles.[40] One limit to expansion, of course, is the fact that the sites where coal is produced are now always near navigable waterways.

Another problem with expanding the use of barges comes from the need for dredging channels. Where dredging is performed, significant disruption of natural processes can occur. In addition, the question of what to do with the dredged material has never been answered satisfactorily. Relocating it under-

water can spread polluted matter from the bottom of the river, but it is difficult to dispose of it in any other way.[41]

Other Methods

Mine-Mouth Energy Plants

One technique which can be called "coal transportation" is mine-mouth energy generation. Instead of hauling the coal away from the mine and burning it there, energy can be produced directly at the site of the mine; electricity is then transported over extra-high voltage wire to the point of consumption.

This technique has not yet proven economical on a large scale. A system which is both profitable and efficient has yet to be developed. "The economics of this form of transport are complex, and future use also depends upon improved technology."[42] One serious problem of mine-mouth generation is water use: it requires even more water to process a given amount of coal than slurry pipelines would. "This alternative uses six-to-eight times the quantity of water...utilized by a coal slurry line which supplies an equivalent-sized electric power plant at the terminus of the coal slurry pipeline."[43]

Conveyor Belts

Conveyor belts are currently only appropriate for short movements (twelve miles or less) to utility plants or loading points. With technological innovations and changes in the market structure, however, they may become practical over greater distances. They could become a major carrier of coal over rough terrain, where they would be especially advantageous.[44]

IV.

THE FUTURE OF COAL TRANSPORTATION IN THE SOUTH

To develop meaningful conclusions regarding the future of coal transportation in the South, it is necessary first to make some observations about the future of coal itself and particularly about coal in the southern region. This section will address some national policies and trends relating to coal and the effects these developments might have on southern coal. The resulting impacts on the coal transportation systems of the southern region will then be considered.

Coal Policy and Trends

The role of coal in the nation's energy future has been loudly proclaimed ever since the OPEC oil embargo in October of 1973. Project Independence, announced six months later by President Nixon, placed heavy emphasis on the expanded use of coal, along with increased domestic oil and gas production, in making America energy self-sufficient. President Carter's National Energy Plan of 1977 strongly urged increased coal utilization through an oil and natural gas users' tax, a coal conversion regulatory policy, a strong environmental policy for coal, and an expanded coal research and development program. Other programs at the federal and state level have, among other things, supported coal as a plentiful and reliable source of energy to see the country well into the next century.

Yet despite the programs and proclamations supporting increased utilization, the National Coal Association estimated that in 1980, the industry had the ability to produce 100,000,000 tons more coal than it could find a market for.[45] This was an excess capacity equal to 12 percent of the industry's actual production of 835 million tons. Between 1970 and 1979, U.S. coal production had risen 27 percent. The nation's total petroleum use, which these policies had meant to reduce, had risen exactly the same percentage, and the use of imported oil, which was intended to be halted entirely, had risen to two-and-a-half times its 1970 level. Prices for coal, when adjusted for inflation, peaked in 1975 and have been falling steadily since to a 1980 level equal to 10 percent less than that peak.[46]

The present federal administration is not enthusiastic about retaining many of the coal-related programs that are currently in effect. The administration appears prepared, for example, to fight passage of the oil and gas backout legislation, which requires utilities to begin conversion from those fuels to coal for electricity and would forbid oil or gas-fired electricity generators by 1990. The federal synthetic fuels program, heralded by President Carter as a major step in making the nation energy-independent and endowed with $88 billion, has been severely criticized by the current administration; therefore, the future of the Synthetic Fuels Corporation, set up to oversee synfuel development, appears very uncertain. Other proposed changes, such as those strongly supported by Interior Secretary Watt to open up federal land for mineral development, would add to the nation's overall coal production, but since these federal lands lie almost exclusively in the West, their opening would be seen by southern producers only as added competition.

On the brighter side, there are also proposals that would relax the constraints on the mining and burning of coal. Modification of the surface mining requirements would be particularly advantageous to the Appalachian states, since their rugged terrain make it especially difficult to comply with existing reclamation laws and puts them at a competitive disadvantage with western states, where the coal-bearing land is generally flat, with thick seams and a high ratio of coal to overburden. Easing emission requirements would increase the usability of the high sulphur coal found in much of the western part of the southern region. For example, the Clean Air Act of 1970 is attributed with being the cause of sharp decline in the demand for coal from west Kentucky. Coal found in that area is characterized as relatively high in sulphur content. The sulphur removal processes necessary to meeting the standards of the Clean Air Act make use of this type of coal uneconomical. Coal production in west Kentucky has dropped by 42 percent since 1974.[47] Modification of the existing laws to make it less expensive to use high sulphur coal would greatly encourage production there and in many other parts of the South.

Perhaps the largest single factor affecting the future demand for southern coal is exportation. Though exports are not an extremely large part of the current total demand for U.S. coal, 12 percent in 1980, they do comprise the sector with the largest potential for growth. Total U.S. coal exports were 39.8 million tons in 1978, 64.8 million tons in 1979, and 89.9 million tons in 1980.[48] All but one percent of these exports come from Appalachian coal fields. Total exports in 1980 amounted to 23 percent of the production of the southern region. With major expansions of the Atlantic and Gulf port facilities already underway and with the railroads which supply export coal making massive expenditures in upgrading their storage and land movement facilities in the port areas, the export market for southern coal looks optimistic.[49]

The creation of a coal-based synthetic fuels industry will have a positive effect on the nationwide demand for coal. President Carter's Energy Security Act called for a synthetic fuels industry that would produce 2 million barrels of synthetic fuel per day. It would require 200 to 300 million tons of coal per year to meet this goal. This was probably an overly ambitious target in the first place and with federal support for synfuels waning, the actual demand for coal for that industry, while still appreciable, will be somewhat less. Additionally, much of the coal demanded by the synfuel industry will be supplied by non-southern producers. One intent of the synthetic fuel supporters was to provide a market for the relatively low grade coal that might otherwise be unusable. As noted earlier, much of the coal of the southern region is high-grade premium quality. The bulk of the benefits of the synthetic fuel program as it materializes appear destined for the western and northeastern U.S. and that part of the southern region where high sulphur coal is found.

The bulk of southern coal is sold to utilities in the South. In spite of talk of the boom in the Sunbelt, utility companies in that region have the lowest anticipated annual growth rate of any region in the U.S., ranging from 2.9 percent to 3.5 percent. The highest growth rates are expected to be in the central and western regions, with growth rates of 10.7 percent and 25.7 percent, respectively.[50] These latter utilities will be served primarily by mines in the northcentral and western U.S.

Overall, it would appear that the southern region is in for an extended period of steady, moderate growth in coal production with whatever surges

might occur coming in the exports area.

Implications For Transportation

Rails

Rails currently are, and for the next several years, at least, will continue to be, the major mover of coal produced in the southern region. During the surge in demand for coal in the 1980s railroad companies were often criticized for not being able to meet the demand placed on them by the burgeoning coal market. More recently the industry has seen several mergers and reorganizations in its ranks. These changes, as well as the passage of the Staggers Act deregulating the industry, will mean that rails will be better able to raise capital and invest in such facilities as gathering yards, rail beds, locomotives and cars.[51]

The future benefit of these mergers and of deregulation will not be spread evenly among the coal shippers, however. Deregulation allows the rails greater flexibility in matching up the costs of serving a specific customer with the rates charged that customer. Under regulation, all customers in a given class were charged the same rate without consideration being given to individual costs of service. Deregulation will have a positive rate effect on one group of customers - those who were paying rates greater than their costs of service - and a negative rate effect on the other group - those who were paying rates less than the costs of delivering the service to them.

Coal shippers have long complained of slow service, poor track conditions and car shortages. The joint effects of deregulation and mergers will be to give the rails the financial capability and the incentive to upgrade the system and provide the service demanded by customers. For coal suppliers in convenient locations and with profitable volume, future rail service should improve; rates might well drop. For out-of-the-way suppliers with small and erratic volume, service might continue to decline while rates rise substantially.

The major rail systems in the South would not face a capacity constraint, even with a substantial increase in volume. With little added expense for repair and maintenance the rail beds themselves could carry a considerable increase in traffic. The hopper car fleet can be expanded on fairly short notice. The delivery time for new hopper cars is six months, for locomotives, eighteen months. By contrast, the start-up time for a typical coal mine is two years.[52]

In summary, it appears that the rail system will be able to adequately provide service to those who can pay for it.

Barges

Barges are an efficient and desirable mode of transportation for those coal shippers whose market route allows them access to waterways. Barges currently have the capacity to meet the demands placed on them and the inland shipyards have the construction capacity to allow a 15-to-20 percent annual

growth rate.[53] The availability and capacity of river terminals is also adequate and does not represent a restricting factor.

A problem arises with the system of locks on the inland waterways, however. The length and width of the barges locks can serve is necessarily limited, and since they can only accommodate one vessel at a time, there is a definite upper limit on the amount of coal that can pass through them in a given time period. Many of the locks serving the coal trade already operate at capacity and many more are expected to do so within the next five-to-ten years. For the inland waterway system to meet the demands placed on it by the coal industry, considerable efforts will have to be forthcoming from the Army Corps of Engineers, which has responsibility for the system. Expanding the capacity of locks is an expensive and time-consuming operation, however, generally taking nine-to-ten years to complete.[54]

While the Corps of Engineers is actively studying future waterway needs and options, it is less than certain that adequate federal funds will be available to meet these needs. In keeping with an overall spirit of less government involvement, the current federal administration is supportive of user-fees in the form of a fuel tax on barges for maintaining the inland waterway system. Such a fee was enacted in 1980, starting at 4¢ per gallon, and is to increase to 10¢ per gallon by 1985. The new administration has proposed increasing that fee to 29¢ per gallon in 1985. The Water Transportation Association estimates that this tax would result in a 10 percent average increase in barge rates.[55] In addition, consideration is being given to a separate lockage fee or other charges related to the cost of new construction and maintenance of different segments of the river system.

Overall, with the approach of certain capacity constraints, the likelihood of higher rates related to waterway upkeep, and deregulation allowing rails to be more competitive in price, the relative attractiveness of barges will tend to diminish, but given their inherent efficiencies, they will continue to be used by coal shippers up to their load-carrying capacity.

Trucks

Trucks play a vital and, for many small and difficult to reach mines, an indispensable role in the transportation of coal. Since new rail spurs are seldom economically justified and new waterways are not a possibility (with the possible exception of the Tennessee-Tombigbee Waterway now under construction), trucks will serve an increasing function in moving coal to market as large existing coal seams are mined out and producers turn to smaller mines further from existing rail and barge facilities. Since trucks have a much higher ton/mile cost of operation, dependence on them will increase the overall delivered cost of coal from the region.[56]

Of more importance to the regions where trucks are a major factor are the public costs that extensive use of heavy trucks imposes on an area. These public costs consist primarily of increased truck-related road repair and maintenance expenditures, but they also include such non-monetary costs as the inconvenience, pollution, and health and safety problems resulting from increased coal truck use.

In Kentucky alone the cost of upgrading just the state-supported part of the coal-haul road system has been estimated by the Federal Highway Adminis-

tration at over $8 billion. Coal-haul roads are being worn out much faster than they are being replaced, and with road funds in the various states slowing or actually declining, a reversal of this trend is not in sight. Assuming that taxpayers will not be content to simply allow roads in the coal-producing areas to turn to dust, new revenues to support these roads will have to be forthcoming. It would seem likely that at least part of any such revenues will be borne directly by the coal industry.

Continuing efforts can be expected in the areas of improved weight violation enforcement and the design of less destructive coal trucks, but with a large existing truck fleet and with a major part of the coal industry dependent upon them, radical solutions to the problem do not appear likely.

Coal Slurry Pipelines

The future of coal slurry pipelines in the South hinges almost exclusively on one issue, federal eminent domain legislation. Unless eminent domain is extended to coal slurry, it is doubtful that that form of transportation will ever become a factor in the southern region. Coal producers in the region are generally separated from their customers by one or more states, and state-only passage of eminent domain would not appear to be sufficient to allow construction of a major southern facility.

Should eminent domain be granted at the federal level, industry is prepared to introduce the slurry process quickly. A spokesman for the company that is proposing to build a 1500-mile split pipeline running from West Virginia and southern Illinois to Florida has said that if the federal legislation were passed in 1981, the necessary permitting, financing, purchase of rights-of-way, and construction of the pipeline would be completed within six years, at a cost of approximately 3 billion dollars.[57] This facility would carry approximately 50 million tons of coal annually.

Because of their lower costs of operation, coal slurry pipelines would have the direct effect of reducing transportation rates for consumers. They would have the indirect effect of holding down the freight rates on other modes of transportation, because of the increased competition they would offer in the market place. The pipeline previously mentioned would save utility customers up to $54 billion, it is estimated, over a 20-year period. Should federal eminent domain legislation be extended to coal slurry, this pipeline and others, some as yet unplanned, would be expected to benefit coal producers and the region generally by holding down shipping costs and expanding the overall capacity of the region's transportation system.

Conclusions

Coal is once again being called upon to make a major contribution to the nation's energy future. Since 1973, the industry has been told repeatedly to prepare to serve a much larger role in meeting our energy needs. The actual demand for the industry's product has never come up to the official expectations, however. The coal producers have for years had the capacity to increase their output dramatically. The coal industry has been ready but the coal users have not.

Conditions now appear right to insure an extended period of sustained, though moderate, growth in the southern coal industry. Export markets are rapidly developing, opening up new outlets for the region's coal. The synthetic fuel industry will provide a major dependable market for southern coal, much of it the low-quality type that often has difficulty finding a buyer. Perhaps most importantly, the U.S. and the World are finally adapting to permanently high prices for petroleum, natural gas, and other fuel sources. Given coal's relative cost advantage and the fact that it is a reliable, long-term domestic supply source, major energy users are expected to continue their trend of shifting away from other fuels to coal.

In general, the South appears to have a transportation system in place that can handle a moderate or even fairly significant increase in the volume of coal movement, provided that increase is steady and foreseeable. The basic coal transportation infrastructure - the rail beds, waterways, and, to a more qualified extent, the roadways - can carry a much greater volume of coal traffic than it now bears. With adequate notice and assurance of the demands to be placed on it, the infrastructure is capable of being upgraded and modified to meet the long-term transportation needs of the coal industry. The variable components of the transportation system, the rail cars, barges, and trucks, can be increased on fairly short notice to meet any reasonable increase in coal volume.

The major unresolved problem in the coal transportation system in the South is the coal-haul road network. As southern coal production shifts toward more and smaller mines, the demands placed on the highway network will increase. In many parts of the region that network is already overburdened and deteriorating. Since funding for coal-haul roads is not tied directly to their usage, unless new and innovative funding mechanisms are developed, these roads will only get worse.

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APPENDIX A: DEFINITIONS

COAL PRODUCTION AND PURCHASES

The amount of coal produced is reported by Form EIA 6 respondents as coal production and/or purchases.

Production: When a responding company produces and distributes its own coal to a consumer, the coal is reported as production.

Purchases: When a responding company purchases coal which has been produced by another company, the coal is reported as a purchase. This coal may be purchased from current production or stocks. Companies purchasing coal are frequently wholesale coal dealers (including brokers) or retail coal dealers.

If a reported purchase was made from another Form EIA 6 responding company, it is included in the report ... the respondent who distributed it, and an adjustment is made in order that duplicate tonnages are not included in the presentation of data.

CONSUMER CATEGORIES

Coke Plants: All plants where coal is carbonized for the manufacture of coke in slot or beehive ovens. Only coal that is carbonized to produce coke is reported. Shipments of coal to coke plants for use in space heating or electric power generation and coal used to produce form coke are included in the Other Industrial consumer category.

Electric Utilities: All privately owned companies and all publicly owned agencies engaged in the production of electric power for public use. Publicly owned agencies include Municipal electric utilities; Federal power projects, such as the Tennessee Valley Authority (T.V.A.); and rural electrification cooperatives, power districts, and state power projects.

Other Industrial: Industrial users, not including coke plants, that are engaged in the mechanical or chemical transformation of materials or substances into new products; and companies engaged in agriculture, mining (other than coal mining), or construction industries. This category also includes coal used for gasification or liquefaction, and coal used at Form EIA 6 respondents' mines.

Residential/Commercial: Housing units; wholesale and retail businesses (except coal wholesale dealers); health institutions (hospitals); social and educational institutions (schools and universities); and Federal, State, and local governments (military installations, prisons, office buildings). Coal sold by Form EIA-6 respondents to their employees is included in this category.

Transportation: Shipments of coal to railroad companies to be used as fuel and shipments of coal to be used as vessel/ship fuel.

METHODS OF TRANSPORTATION

When more than one method of transportation is involved, the shipment is reported as follows: A. Water Transportation: If water transportation was involved, the shipment is reported as one of the three types of water shipments i.e., river, Great Lakes, or Tidewater Piers and Coastal Ports. B. Rail Transportation: If only rail and truck were involved, then the method of transportation is reported as rail. C. Truck: The method of transportation is reported as truck only when the coal is shipped directly to the consumer by truck.

Great Lakes: Shipments of coal moved to consumers via the Great Lakes. These shipments are moved via the Great Lakes Coal Loading Docks which are identified by name and location as follows: Superior Midwest Energy Terminal, Superior, Wisconsin; Bessemer & Lake Erie Coal Storage & Transfer Facility, Conneaut, Ohio; B&O Railroad Coal Loading Dock, Lorain, Ohio; C&O Railroad Presque Isle Docks, Toledo, Ohio; Lakefront Dock & Railroad Terminal Company Coal Loading Dock, Toledo, Ohio; N&W Sandusky Coal Pier No.3, Sandusky, Ohio; ConRail Coal Transfer Facilities, Ashtabula, Ohio; Rail to Water Transfer Corp. Dock, Chicago, Illinois.

Rail: Shipments of coal moved to consumers by rail, private or public/commercial. Included is coal hauled to or away from a railroad siding by truck.

River: Shipments of coal moved to consumer via river by barge, except shipments to Great Lakes Coal Loading Docks or Tidewater Piers or Coastal Ports.

Tidewater Piers and Coastal Ports: Shipments of coal moved to Tidewater Piers and Coastal Ports for further shipments to consumers via coastal water or ocean. The Tidewater Piers are identified by name and location as follows: B&O Curtis Bay Coal Piers, Baltimore, Maryland; C&O Coal Piers Nos. 14 & 15, Newport News, Virginia; N&W Lamberts Point Coal Piers Nos. 5 & 6, Norfolk, Virginia; Alabama State Docks Bulk Handling Plant, Mobile, Alabama; Alabama State Docks/McDuffie Terminals, Mobile, Alabama; Canton Coal Pier, Baltimore Harbor on Chesapeake Bay; Greenwich Coal Pier, Greenwich Point, Philadelphia, Pa. on Delaware River; Port Richmond Pier, Pier 18-Port Richmond, Philadelphia, Pa. on Delaware River; Galveston Regional Coal Distribution Center, Pelican Island, Galveston, Texas;

International Marine Terminals/Plaquemines Parish Terminal, Mile 57 AHP-Mississippi River, approx. 30 miles South of New Orleans; Energy Terminals of Houston, Inc., a Subsidiary of Soros Associates, Houston, Texas. Coastal Ports are those located at Charleston, South Carolina; New York, New York; San Diego, California; Los Angeles, California; and Seattle, Washington.

Tramway, Conveyor, or Slurry Pipeline: Shipments moved to consumers by tramway, conveyor, or slurry pipeline.

Truck: Shipments of coal moved to consumers by truck.

Definition of Coal Producing Districts

District 1

Maryland: All mines in the State.

Pennsylvania: All mines in the following counties; Bedford, Blair, Bradford, Cambria, Cameron, Centre, Clarion, Clearfield, Clinton, Elk, Forest, Fulton, Huntingdon, Jefferson, Lycoming, McKean, Mifflin, Potter, Somerset, and Tioga. Selected mines in the following counties: Armstrong County (part), all mines east of the Allegheny River, and those mines served by the Pittsburgh & Shawmut Railroad located on the west bank of the river; Fayette County (part), all mines located on and east of the line of Indian Creek Valley branch of the Baltimore & Ohio Railroad; Indiana County (part), all mines not served by the Saltsburg branch of the Consolidated Rail Corporation; and Westmoreland County (part), all mines served by the Consolidated Rail Corporation from Torrance, east.

West Virginia: All mines in the following counties; Grant, Mineral, and Tucker.

District 2

Pennsylvania: All mines in the following counties; Allegheny, Beaver, Butler, Green, Lawrence, Mercer, Venango, and Washington. Selected mines in the following counties: Armstrong County (part), all mines west of the Allegheny River except those mines served by the Pittsburgh & Shawmut Railroad; Fayette County (part), all mines except those on and east of the line of Indian Creek Valley branch of the Baltimore & Ohio Railroad; Indiana County (part), all mines served by the Saltsburg branch of the Consolidated Rail Corporation; and Westmoreland County (part), all mines except those served by the Consolidated Rail Corporation from Torrance, east.

District 3

West Virginia: All mines in the following counties; Barbour, Braxton, Calhoun, Doddridge, Gilmer, Harrison, Jackson, Lewis, Marion, Monongalia, Pleasants, Preston, Randolph, Ritchie, Roane, Taylor, Tyler, Upshur, Webster, Wetzel, Wirt, and Wood. Selected mines in the following county: Nicholas County (part), all mines served by or north of the Baltimore & Ohio Railroad.

District 4

Ohio: All mines in the State.

District 5

Michigan: All mines in the State.

District 6

West Virginia: All mines in the following counties; Brooke, Hancock, Marshall, and Ohio.

District 7

Virginia: all mines in the following counties; Montgomery, Pulaski, Wythe, Giles, and Craig. Selected mines in the following counties: Buchanan County (part), all mines in that portion of the county served by the Richlands-Jewell Ridge branch of the Norfolk & Western Railroad and in that portion on the headwaters of Dismal Creek east of Lynn Camp Creek (a tributary of Dismal Creek);and Tazewell County (part), all mines in those portions of the county served by the Dry Fork branch to Cedar Bluff and from Bluestone Junction to Boissevain branch of the Norfolk & Western Railroad and Richlands-Jewell Ridge branch of the Norfolk & Western Railroad.

West Virginia: All mines in the following counties; Greenbrier, Mercer, Monroe, Pocahontas, and Summers. Selected mines in the following counties: Fayette County (part), all mines east of Gauley River and all mines served by the Gauley River branch of the Chesapeake & Ohio Railroad and mines served by the Norfolk & Western Railroad; McDowell County (part), all mines in that portion of the county served by the Dry Fork branch of the Norfolk & Western Railroad and east thereof; Raleigh County (part), all mines except those on the Coal River branch of the Chesapeake & Ohio Railroad and north thereof; and Wyoming County (part), all mines in that portion served by the Guyandot branch of the Norfolk & Western Railroad lying east of the mouth of Skin Fork of Guyandot River and in that portion served by the Virginia division main line of the Norfolk & Western Railroad.

District 8

Kentucky: All mines in the following counties in eastern Kentucky; Bell, Boyd, Breathitt, Carter, Clay, Elliott, Floyd, Greenup, Harlan, Jackson, Johnson, Knott, Knox, Laurel, Lawrence, Lee, Leslie, Letcher, McCreary, Magoffin, Martin, Morgan, Owsley, Perry, Pike, Rockcastle, Wayne, and Whitley.

North Carolina: All mines in the State.

Tennessee: All mines in the following counties; Anderson, Campbell, Claiborne, Cumberland, Fentress, Morgan, Overton, Roane, and Scott.

Virginia: All mines in the following counties; Dickson, Lee, Russell, Scott, and Wise. Selected mines in the following counties: Buchanan County (part), all mines in the county, except in that portion on the headwaters of Dismal Creek,

east of Lynn Camp Creek (a tributary of Dismal Creek) and in that portion served by the Richlands-Jewell Ridge branch of the Norfolk & Western Railroad; and Tazewell County (part), all mines in the county except in those portions served by the Dry Fork branch of the Norfolk & Western Railroad and branch from Bluestone Junction to Boissevain of Norfolk & Western Railroad and Richlands-Jewell Ridge branch of the Norfolk & Western Railroad.

West Virginia: All mines in the following counties; Boone, Cabell, Clay, Kanawha, Lincoln, Logan, Mason, Mingo, Putnam, and Wayne. Selected mines in the following counties: Fayette County (part), all mines west of the Gauley River except mines served by the Gauley River branch of the Chesapeake & Ohio Railroad; McDowell County (part), all mines west of and not served by the Dry Fork branch of the Norfolk & Western Railroad; Nicholas County (part), all mines in that part of the county south of and not served by the Baltimore & Ohio Railroad; Raleigh County (part), all mines on the Coal River branch of the Chesapeake & Ohio Railroad and north thereof; and Wyoming County (part), all mines in that portion served by the Guyandot branch of the Norfolk & Western Railroad and lying west of the mouth of Skin Fork of Guyandot River.

District 9

Kentucky: all mines in the following counties in western Kentucky; Butler, Christian, Crittenden, Daviess, Hancock, Henderson, Hopkins, Logan, McLean, Muhlenberg, Ohio, Simpson, Todd, Union, Warren, and Webster.

District 10

Illinois: All mines in the State.

District 11

Indiana: All mines in the State.

District 12

Iowa: All mines in the State.

District 13

Alabama: All mines in the State.

Georgia: All mines in the State.

Tennessee: All mines in the following counties; Bledsoe, Grundy, Hamilton, Marion, McMinn, Rhea, Sequatchie, Van Buren, Warren, and White.

District 14

Arkansas: All mines in the State.

Oklahoma: All mines in the following counties; Haskell, Le Flore, and Sequoyah.

District 15

Kansas: All mines in the State.

Missouri: All mines in the State.

Oklahoma: All mines in the following counties; Coal, Craig, Latimer, Muskogee, Okmulgee, Pittsburg, Rogers, Tulsa, and Wagoner.

Texas: All mines in the State.

District 16

Colorado: All mines in the following counties; Adams, Arapahoe, Boulder, Douglas, Elbert, El Paso, Jackson, Jefferson, Larimer, and Weld.

District 17

Colorado: All mines except those included in District 16.

New Mexico: All mines except those included in District 18.

District 18

Arizona: All mines in the State.

California: All mines in the State.

New Mexico: All mines in the following counties: Grant, Lincoln, McKinley, Rio Arriba, Sandoval, San Juan, San Miguel, Santa Fe, and Socorro.

District 19

Idaho: All mines in the State.

Wyoming: All mines in the State.

District 20

Utah: All mines in the State.

District 21

North Dakota. All mines in the State

South Dakota: All mines in the State

District 22

Montana: All mines in the State.

District 23

Alaska: All mines in the State.

Oregon: All mines in the State.

Washington: all mines in the State.

District 24. (Pennsylvania Anthracite)

Pennsylvania: All mines in the following counties: Carbon, Columbia, Dauphin, Lackawanna, Lebanon, Luzerne, Northumberland, Schuylkill, Sullivan, and Susquehanna.