

AN ANALYSIS OF COST FACTORS OF 1974  
COAL PRICES

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## Table of Contents

- I. Introduction
- II. Coal Price Trends
- III. Estimates of Coal Costs
- IV. Analysis of Production Cost Components
  - A. Labor
  - B. Materials
  - C. Capital Costs
  - C. Taxes and Insurance
- V. Analysis of Environmental Cost Components
  - A. Environmental regulations related to coal production
  - B. Secondary effects of environmental regulations
- VI. Conclusion

## I. Introduction

Rapid increases in coal prices in 1974 have raised questions concerning the factors that have caused these increases. The factors commonly cited as primary influences on coal prices include increases in wages and materials costs, increased costs for meeting environmental standards and lower mining productivity resulting from the implementation of mine health and safety standards. However, seldom, if ever, are such cost increases defined quantitatively in relation to the selling price of coal.

It is the purpose of this paper to identify the various cost 1/ factors that influence the price of coal and to place them in perspective relative to the total price of coal.

The cost structure of coal production varies widely from mine-to-mine because of different mine localities, mining methods, geological formations and state regulations. Likewise, pricing structures vary for different grades and quality of the coal, quantities purchased, duration of purchase contract, transportation costs, and other economic factors. Production costs are seldom published for proprietary reasons and most large sales agreements are negotiated separately to reflect current market conditions and specific producer-customer requirements.

Because of the complexities of the costs and pricing structures, it was necessary to use aggregate and average data to evaluate trends in coal pricing and factors that might affect various components of

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1/ The term "cost" is used as the expenditures associated with the production of coal. "Price" is used as the expenditures in purchasing the coal.

production costs. Although it is understood that such aggregate or average data may not be representative of any given coal production facility or price from a given mine, it is believed that this approach presents a fair representation of the coal industry as a whole.

## II. Coal Price Trends

The upward trend of coal prices is exemplified in the prices paid by the electrical generating utilities--an industry that consumes 65 percent of all coal produced in the United States. The price trends for coal, as burned by the electric utilities, are shown in Table I along with comparable prices for oil and natural gas.

TABLE 1.--Price of As-Burned Fuel\*

	Coal	Oil	Gas	
	¢ per million BTU	¢ per million BTU	¢ per million BTU	
	(\$/ton)			
1967 - yearly average	25.2	(5.55)	32.2	24.7
1968 - yearly average	25.5	(5.60)	32.8	25.1
1970 - yearly average	31.1	(6.85)	36.6	27.0
1972 - yearly average	38.2	(8.40)	58.8	30.3
1973 - January	37.8	(8.32)	67.0	29.0
1974 - January	51.4	(11.30)	162.7	37.3
1974 - June	69.7	(14.70)	195.1	47.7
1974 - December	88.9	(18.75)	204.6	55.0

\*Source.--Steam-Electric Plant Factors, 1973, National Coal Association, Washington, DC, and FPC News, vol. 8, no. 13. 3/28/75.  
Federal Power Commission, Washington, DC.

As shown above, coal prices increased slowly until 1973 and then began to rise rapidly, following the same pattern as oil prices. Gas prices also followed the oil price pattern but to a lesser degree-- probably because of the constraint of continuing price regulation.

Electric utilities purchase about 80 percent of their coal under long-term contracts typically of 10-30 years duration; the remainder is purchased on the open, or "spot" market. Since a large fraction of the coal is purchased under long-term contracts, the average prices for coal react slowly to new price increases. Although major price increases were negotiated in many of the long-term coal contracts in 1974, only a fraction of the total number of contracts were initiated or renegotiated during 1974. Hence, the full impact of increased contract coal prices was not realized during 1974, but would have a continuing effect in coming years.

Increases in contract and spot coal prices are shown in Table II.

TABLE II.--Average Steam Coal Prices  
FOB Utility Plant\*

	<u>Contract Prices</u>		<u>Spot Prices</u>	
	¢ per Million BTU	\$ per Ton	¢ per Million BTU	\$ per Ton
January 1974	44.9	9.83	75.8	17.02
June 1974	54.9	11.87	114.8	25.84
December 1974	68.1	14.20	142.1	31.05

Percent increase,

January to December, 1974 52%

87%

\* FPC News, vol. 8, no. 13, 3/28/75. Federal Power Commission, Wash., DC.

As shown, spot prices had increased 87 percent during the year, and contract prices 52 percent. Some of the increase in spot prices could be attributed to market pressure caused by the coal strike during the last quarter of 1974; typically spot prices are sensitive to short-term demand fluctuations whereas contract prices are more stable. 2/

The prices for metallurgical coal generally run 20-30 percent higher than steam coal. In November, 1974, spot prices of metallurgical coal had risen to the \$70-80 range--these high prices again reflect--in part--the pressures of the coal strike.

### III. Estimates of Coal Costs

Coal production costs vary for different methods of mining, geological conditions and locality. The Tennessee Valley Authority 3/ estimated the selling price of coal produced in their region as of January, 1974 as follows:

Underground mining	-	\$9-13 per ton F.O.B. mine
Area strip mining	-	6- 7 per ton
Contour strip mining	-	7-14 per ton

The above estimates included profits equivalent to a 20 percent return on investment before taxes.

Coal production costs for new hypothetical underground and surface mining operations were prepared by the U.S. Bureau of Mines. 4/ The production cost estimates for underground mines were based on 20 year mine life, wages

2/During the first quarter of 1975, a reduction of spot prices is indicated, however, contract prices are continuing their climb.

3/Private communication.

4/Basic estimated capital investment and operating costs for underground bituminous coal mines. U.S. Bureau of Mines, IC-8632, 1974. And basic estimated capital investment and operating costs for coal strip mines. U.S. Bureau of Mines, IC-8661, 1974.

and union welfare payments as of November 12, 1973, and costs for materials and equipment in accordance with 1973 indexes. Likewise, the production cost estimates for surface mines were based on 20-year mine life, wages and union welfare payments as of May 12, 1974 and costs for materials and equipment based on 1973 and early 1974 indexes. Breakdowns of the BOM estimated production costs for a 3.18 million ton per year underground mine and a 6.72 million ton per year strip mine are given in Table III a and b.

TABLE IIIa.--Underground Coal Mining Cost Elements, 1973

<u>Labor costs</u>	<u>\$/ton</u>
production direct labor	1.83
maintenance direct labor	.26
labor overhead	.73
union welfare fund	.75
indirect labor costs	.53
Total labor costs	<u>4.10</u>
 Materials costs	
supplies	1.43
power	.16
Total materials costs	<u>1.59</u>
 Fixed costs	
taxes and insurance	.15
depreciation	.66
Total fixed costs	<u>.81</u>
 Total costs	<u><u>6.50</u></u>
 Estimated selling price, F.O.B. mine	 <u>7.63</u>
(equivalent to 35¢ per million BTU)	

TABLE IIIb.--Surface Coal Mining Cost Elements, 1973

Labor costs	<u>\$/ton</u>
production direct labor	0.18
maintenance direct labor	0.15
labor overhead	0.11
union welfare fund	0.80
indirect labor costs	<u>0.07</u>
Total labor costs	1.31
Materials costs	
supplies	0.53
power	<u>0.10</u>
Total materials costs	0.63
Royalty, license and bond	<u>0.59</u>
Fixed costs	
taxes and insurance	0.15
depreciation	<u>0.54</u>
Total fixed costs	0.69
Reclamation	<u>0.03</u>
Total costs,	<u><u>3.25</u></u>
Estimated selling price, F.O.B. mine	<u>4.23</u>

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The TVA and BOM estimates of selling prices are exclusive of transportation costs from mine to use point. Transportation costs can range from under a dollar per ton to 8-10 dollars per ton, depending on distance. However, the national average cost was about \$3.70 per ton in 1972 5/ and estimated to be about \$4.00 per ton in 1974. 6/ Adding

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5/ Bituminous Coal Facts-1972. The National Coal Association, Wash., DC.

6/ Assumes an 8 percent increase in rates allowed by the ICC.



the average transportation costs to the estimated production costs, the estimated delivered costs of coal in the 1973-1974 period would be \$11.33 per ton for underground coal and \$7.93 per ton for surface-mined coal. Also, since the production of underground and surface coal is about equal, the estimated average delivered price for all coal would be \$9.63 per ton. The degree of agreement between the estimated prices for coal and actual prices paid by electrical utilities in the 1973-early 1974 period (see Table I) indicates that the estimated costs were indeed realistic.

#### IV. Analysis of Production Cost Components

The basic cost components comprising the aggregate coal production costs were examined to determine the probable incremental cost increases that could have been expected during 1974. The components cost breakdowns shown in Table III a and b were used as a baseline for beginning of 1974.

##### A. Labor

The two major labor-related factors are wages and productivity. Approximately 75 percent of all coal production is performed by members of United Mines Workers Union. During the first ten months, union labor wages remained unchanged as governed by union contract; the last incremental wage increase allowed under the contract became effective November, 1973. Effective November, 1974, the new union labor contract provided wage increase of about 65 percent over a three year period. By applying this increase to the "total labor costs" shown in Table III a & b, the new labor contract would increase the "wages" component about \$2.66

per ton of underground mined coal and \$0.85 per ton of surface mined coal. However, since most coal purchasing contracts contain wage escalation provisions, only the first year's wage increases could be included in the 1974 costs. Therefore, it is estimated that only one-third of the increase would be seen in 1974, and the incremental average cost of underground and surface mined coal would increase about \$0.09 and \$0.28 per ton respectively.

No data were obtained for possible wage increases for the non-union (about 25 percent of the work force) mine workers. It would be reasonable to assume that their wage increases were similar to those of the union workers.

Productivity, in terms of tons of coal produced per man day, also affects labor costs. Trends in productivity for the different mining methods are shown in Table IV.

TABLE IV.--Coal Production Productivity,

Short Tons Per Day Per Man <sup>7/</sup>

	Underground Mining	Strip Mining	Auger Mining	Average of all Mining
1967	15.1	35.2	46.5	19.2
1968	15.4	34.2	40.5	19.4
1969	15.6	35.7	39.9	19.9
1970	13.8	36.0	34.3	18.8
1971	12.0	35.7	39.0	18.0
1972	11.9	35.9	43.0	17.7
1973	11.7	36.3	45.3	17.6
1974	N.A.*	N.A.	N.A.	N.A.

\*Not Available

<sup>7/</sup>Minerals Yearbook. Coal-Bituminous and Lignite. U.S. Bureau of Mines. 1972. and Mineral Industry Surveys, Coal-Bituminous and Lignite in 1973. U.S. Department of the Interior, January 4, 1975.

Although there are no productivity data available for 1974 the historic trends as shown in Table IV would indicate a decrease in average productivity during 1974 to be no greater than 5 percent. for underground mining, but an increase in the productivity in surfacing mining. The primary cause of decreased productivity in underground mining is the increasing implementation of the 1969 Mine Health and Safety Act. If it is assumed that coal production costs increase in direct proportion to decreases in productivity, then an incremental cost increase of \$0.32 per ton could be added to the 1974 production costs for underground coal. Since productivity of surface mining has been increasing, no incremental cost increases can be added to the average cost of surface mined coal.

#### B. Materials

No direct data are available for recent increases in costs of materials used in the mining industry. However, if it is assumed that increases in costs of mining materials would follow changes in the Wholesale Industrial Price Index, increases of about 20 percent per year would be expected for 1973 and 1974 (see Table V).

TABLE V.--Wholesale Industrial Price Index 8/  
(1967 = 100)

Date	:	Index
	:	
	:	
December 1972		
June 1973		119
December 1973		127
June 1974		137
December 1974		153
		166

8/ Bureau of Labor Statistics data as reported in Business Week.

Assuming a 20 percent increase in mining costs, an incremental increase in coal production costs of about \$0.40 per average ton would be expected in 1974. Power costs had increased significantly during 1974 but the magnitude of increases varies with geographic location and mine operation. If it is assumed power costs increased 50 percent during 1974, increases in underground and surface mining costs would be \$0.08 and \$0.05 per ton respectively.

C. Capital Costs

Capital investment costs are incurred primarily during the start-up period of a mine and are depreciated during its life, e.g. 20 years. Although no industry-wide data were found on increases in capital investment costs during 1974, isolated reports indicate some capital costs are increasing about 20-30 percent per year. If 30 percent increases in capital costs are assumed for 1974, the incremental costs of underground and strip mined coal would be \$0.20 and \$0.16 per ton respectively.

D. Taxes and Insurance

Taxes (excluding income taxes) accounted for about 3 percent of the average cost of a ton of coal according to the BOM estimate (Table IIIa&b). There is no indication of a significant tax increases during 1974 but insurance costs probably increased. As of January, 1974, the coal operators were required by Federal law to assume liability for "black lung" disease benefits for disabled miners. Because of variations in insurance programs and mining operations and the relatively short experience record in claim settlements, accurate cost

data of the added insurance costs are not available. However, an estimate of the insurance costs can be obtained by using the current private black lung insurance rate of \$25 per \$100 of payroll, 9/ the top grade daily wage rate for miners, 10/ and daily productivity data. 11/ Using these data, the added cost per average ton of coal for insurance would be \$0.78 per ton. This cost probably represents the high side of such insurance costs since (1) not all coal mine operators carry insurance, (2) several states have set up their own insurance pools and (3) some companies provide "self-insurance". The last two approaches would probably provide lower-cost insurance than offered by private insurance companies. Also, the cost for black lung insurance would pertain almost entirely to underground mining costs but not to surface mining costs. But since many of the larger mine operators are involved in both underground and surface operations, it was allowed in this analysis that the black lung insurance cost would be applied to all coal production.

#### V. Analysis of Environmental Cost Components

Environmental regulations can affect coal prices in two areas; as a production cost in the mining operation, and, as a pressure on prices for the more environmentally acceptable grades of coal, a secondary environmental affect. Both areas were analyzed to determine their relative effects on coal prices during 1974.

9/Department of Labor, Private Communication.

10/ United Mine Workers Journal. No. 22, Nov. 1974. The top wage rate as of Nov., 1974 is \$55 per day.

11/ Table IV.

A. Environmental Regulations Related to Coal Production

Environmental regulations related to coal mining include land reclamation, subsidence control, and acid mine water control. Such environmental regulations are promulgated primarily through individual state actions. As a result there are variations in requirements and levels of enforcement of the regulations. Most of the major coal producing states had established environmental and reclamation standards by 1971. <sup>12/</sup>

The costs associated with environmental mining regulations vary depending on the specific regulations, the type of mining, and the topography and geology of the area. The greatest environmental costs are associated with the reclamation of strip-mined lands. Estimates of reclamation costs of strip-mined land range from about \$200 to \$4000 per acre, which in terms of cost per ton of coal produced, would be a few cents to \$1 per ton. <sup>13/</sup> Although there are no data for the average cost per ton of coal attributable to environmental regulations, it is doubtful that the costs would exceed \$1.00 per ton of average coal.

B. Secondary Effects of Environmental Regulations

The establishment of sulfur emission standards under the 1970 Clean Air Act Amendments has increased the desirability of burning low-sulfur coals (less than 1 percent sulfur). Since the availability of low sulfur coal is limited, increased market demand could conceivably

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<sup>12/</sup>Environmental Protection in Surface Mining of Coal. U.S. Environmental Protection Agency. Report EPA-670/2-74-093. 1974.

<sup>13/</sup>Coal Surface Mining and Reclamation. A committee print prepared for the Senate Committee on Interior and Insular Affairs by the Council on Environmental Quality, March, 1975.

result in higher prices (although there may not be corresponding increases in production costs). Table VI compares price increases during 1974 for coals of different sulfur contents.

TABLE VI.--Average 1974 Coal Prices by Sulfur Content

Sulfur Content	Average Delivered Price ¢ per million BTU				Average Delivered Price \$ per Ton			
	1/74	6/74	12/74	% Change 1/74-12/74	1/74	6/74	12/74	% Change 1/74 - 12/74
0.5% or less	46.8	45.1	48.0	+ 3	9.46	9.11	9.03	- 5
0.51 - 1.0%	60.0	77.8	96.5	+ 56	12.28	15.58	19.34	+ 57
1.01 - 1.5%	68.2	99.9	133.5	+ 96	16.19	23.38	30.64	+ 89
1.51 - 2.0%	60.4	99.2	124.6	+106	14.28	22.77	28.63	+100
2.01 - 3.0%	49.5	69.1	100.7	+103	11.43	15.76	22.69	+ 98
3.01 or more	41.9	55.2	71.6	+ 71	9.21	12.12	15.43	+ 67

Source: FPC News, Vol. 7, No. 39 and Vol. 8, No. 13.



As shown, the price of coal with less than 1 percent sulfur increased less than the higher sulfur coals -- coal with less than 1 percent sulfur increased in costs about 50 percent whereas coals with sulfur contents in the 1-3 percent ranges increased about 100 percent. These data indicate that the demand for low sulfur coal was not a primary factor that contributed to increased coal prices in 1974.

#### VI. Conclusions

The preceding analysis of expected increases in the cost components of coal production are summarized in Tables VII and VIII. The estimated delivered prices at the end of 1974 for the average ton of underground and surface mined coal were \$13.05 and \$11.70 respectively. The estimated combined average price for delivered coal was \$12.38 per ton; an increase of \$2.70 per ton or about 28 percent during 1974. As shown in Table II, the contract price for coal increased 52 percent to \$14.20 per ton during 1974, and spot prices increased 87 percent to \$31.05 per ton. And, new contracts for coal were negotiated in the low- to mid-twenty dollar a ton range at the end of 1974.

The difference between the estimated average price increases and the actual price increases experienced during 1974, suggest that increased profits are a significant factor in recent coal pricings. This conclusion is supported by the large increases in reported earnings during 1974 by major coal producing companies, as shown in Table IX.

TABLE VII.--Summary of underground mining cost increase  
estimated for 1974

	Estimated cost January 1974 \$/Ton	Estimated Cost increases during 1974 \$/Ton	Estimated cost December, 1974 \$/Ton
Labor Costs (Total)	4.10	1.22	5.32
Materials costs			
supplies	1.43	0.40	1.83
power	0.16	0.08	0.24
Fixed costs			
taxes & insurance	0.15	0.78	0.93
depreciation	0.66	0.20	0.86
Total Production Costs	6.50	2.68	9.18
Estimated selling price (FOB mine)	7.63		10.75
Estimated delivered price (FOB utility)	11.33*	0.30	13.05**

\* assumes \$3.70 per ton average transportation cost.

\*\* assumes \$4.00 per ton average transportation cost.

TABLE VIII.--Summary of surface mining cost increases  
estimated for 1974

	Estimated cost, January, 1974 \$/Ton	Estimated cost increases during 1974 \$/Ton	Estimated cost, December, 1974 \$/Ton
Labor Costs (Total)	1.31	0.28	1.59
Materials costs			
supplies	0.53	0.40	0.93
power	0.10	0.05	0.15
Royalty, license & bond	0.59	----	0.59
Fixed costs			
taxes & insurance	0.15	0.78	0.93
depreciation	0.54	0.16	0.70
Reclamation	0.03	1.00	1.03
Total Production Costs	3.25	2.67	5.92
Estimated selling prices (FOB mine)	4.23		7.70
Estimated delivered price: (FOB utility)	7.93*	0.30	11.70*

\*Assumes \$3.70 per ton average transportation cost.

\*\*Assumes \$4.00 per ton average transportation cost.

TABLE IX.--1974 Increases in Coal Company Earnings <sup>14/</sup>

Year ending Dec. 31 (thousands of \$)

Producing Group	Controlling Company	1974		1973		Percent Change Net Income
		Net Sales	Net Income	Net Sales	Net Income	
Peabody Coal Co.	Kennecott Copper Corp.	1,691,722	210,903	1,425,544	159,406	+ 32
Consolidation Coal	Continental Oil Co.	7,365,200	327,600	4,509,600	242,700	+ 35
Island Creek Coal Co.	Occidental Petroleum Corp.	5,537,505	280,677	3,013,815	71,866	+290
Pittston Co.	Pittston Co.	1,145,729	107,446	682,559	15,341	+600
Amax Coal Co.	American Metal Climax Inc.	1,163,000	148,400	964,000	105,100	+ 41
U.S. Steel Corp.	U.S. Steel Corp.	9,337,600	634,900	7,044,700	325,800	+ 95
Bethlehem Mines Corps.	Bethlehem Steel Co.	5,380,963	342,034	4,137,633	206,609	+ 65
Arch Mineral Corp..	Ashland Oil Co. (Quarter, Dec. 3)	922,072	38,589	637,435	34,353	+ 12
North American	North American Coal Corp.	161,432	4,929	125,183	4,452	+ 11
Old Ben Coal Co.	Standard Oil (Ohio)	2,186,000	147,500	1,482,000	89,400	+ 65

CRS-18

<sup>14/</sup> As reported in Coal Age, vol. 80, no. 3, March, 1975.