ANNUAL PRODUCTION AND DISTRIBUTION OF COAL IN UTAH, 1987

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INTRODUCTION

This report contains coal production and distribution information for the year 1987. It includes geographical and geological background as well as statistical data on coal reserves. Production is shown under various divisions such as county, coal field, and land ownership, with distribution differentiated by type and location of usage. Historical information has been included for comparison. A brief discussion on competition, pricing, and Utah's coal future concludes this report.

GEOGRAPHY AND GEOLOGY

Utah's coal resources are predominantly located in the central and southern parts of the state (figure 1). Although Utah has many coal fields, most of the production, past and present, has been from the Book Cliffs, Wasatch Plateau, and Emery fields, collectively called the "fertile Utah coal crescent" because of the broad crescent-shaped arrangement of the coal outcrops in central Utah. Southern Utah coal fields also contain large amounts of coal but have been too remote and inaccessible to have achieved important production (tables 1 and 2). The southern Utah coal fields with the largest resources include the Kaiparowits Plateau, Alton, and Kolob coal fields. Total Utah coal resources are estimated to be 39 billion short tons (Doelling and Smith, 1982, p. 1).

Table 1.
Utah's coal budget as of 1982 (After Doelling, 1982, p. 25).

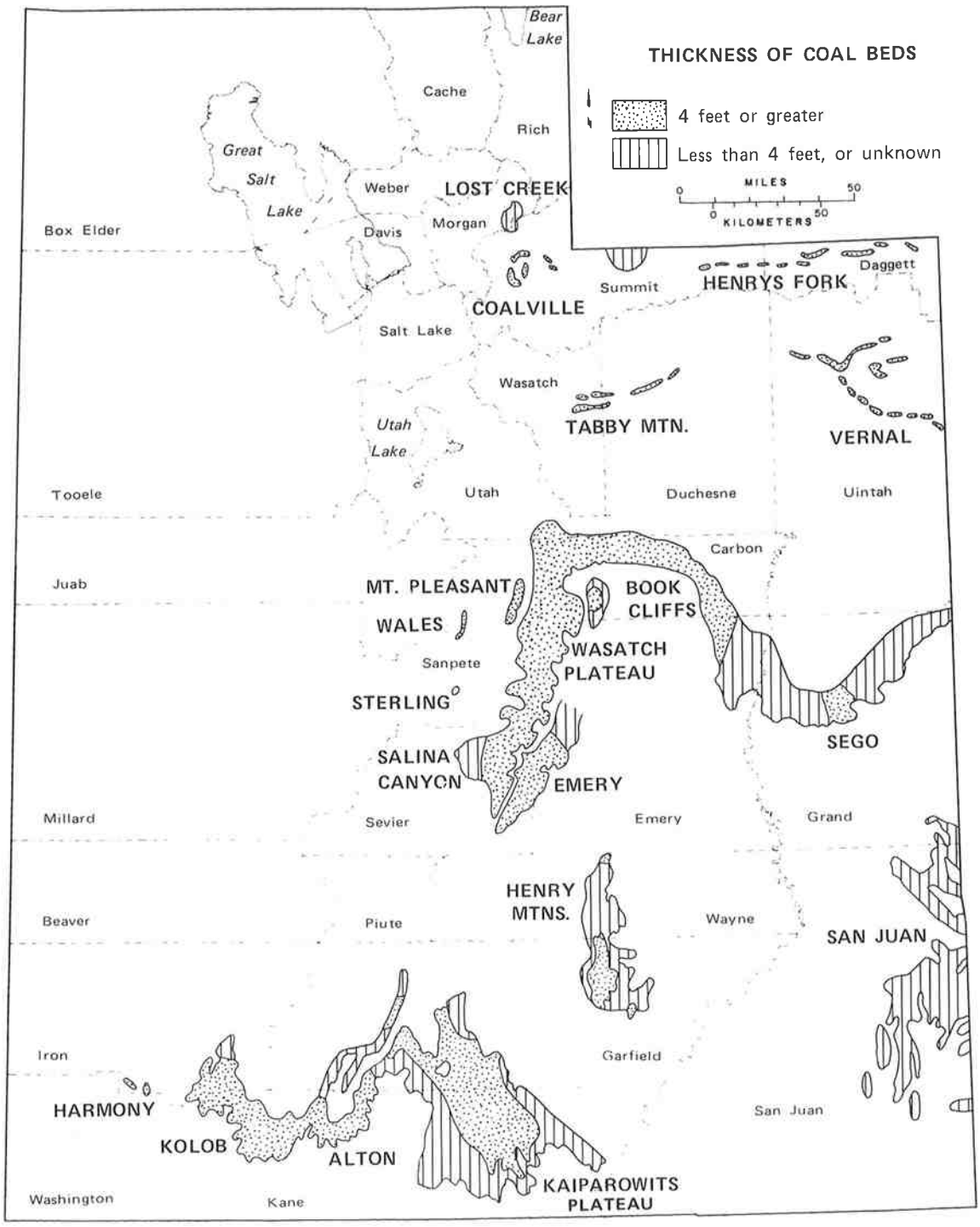
Coalfield	Principal Reserve x 10E6 (tons)	Recoverable Reserve x 10E6 (tons)
Kaiparowits Plateau	7,878.0	2,363.4
Wasatch Plateau	6,378.9	1,814.2
Book Cliffs	3,667.5	1,074.8
Kolob	2,014.3	804.9
Alton	1,509.4	754.7
Emery	1,430.4	427.5
Sego	293.6	129.5
Mt. Pleasant	249.1	99.6
Tabby Mountain	231.2	69.4
Henry Mountains	313.3	141.0
Coalville	186.0	51.6
Vernal	177.1	52.9
Salina Canyon	86.4	29.8
Wales	12.2	3.0
Sterling	2.0	0.5
Harmony	1.3	0.4
Lost Creek	1.1	0.4
Henry's Fork *Insufficient Data*		
San Juan *Insufficient Data*		
Total	**24,431.8**	**7,817.6**

Table 2.
Coal budget balance [thousand short tons] (based on table 1 reserves).

COAL FIELD	Recoverable Reserves	Production To Date	*Sub-total	Total Remaining
BOOK CLIFFS	1,074,800			
1870-1981		237,486		
1982-1985		12,910		
			250,396	824,404
1986 by Coalbed				
Castlegate A		500		
Gilson		687		
Lwr Sunnyside		1,076		
Upr Sunnyside		440		
Rock Canyon		559		
Subseam 3		99		
			3,360	821,044
1987 by Coalbed				
Castlegate A		538		
Gilson		402		
Upr Sunnyside		948		
Rock Canyon		468		
Subseam 3		530		
			2,885	818,159
WASATCH PLATEAU	1,814,200			
1870-1981		160,679		
1982-1985		40,031		
			200,710	1,613,490
1986 by Coalbed				
B Seam		634		
Blind Canyon		3,132		
Hiawatha		1,706		
Upr Hiawatha		2,360		
Lowr O'Connor		874		
Upr O'Connor		633		
Wattis		1,430		
			10,769	1,602,721
1987 by Coalbed				
B Seam		550		
Blind Canyon		2,882		
Hiawatha		3,782		
Upr Hiawatha		2,228		
Upr O'Connor		2,280		
Wattis		1,805		
			13,527	1,589,194
EMERY	427,500			
1870-1981		5,723		
1982-1985		1,580		
			7,303	420,197
1986 by Coalbed				
Ferron I Bed		503		
			503	419,694
1987 by Coalbed				
Ferron I Bed		269		
			269	419,425
SEGO	129,500			
1870-1981		2,654		
1982-1987		0		
			2,654	126,846
COALVILLE	51,600			
1870-1981		4,262		
1982-1986		0		
			4,262	47,338
1987 by Coalbed				
Frontier-Wasatch		33		
			33	47,305
OTHERS	4,320,000			
1870-1987		2,332		
			2,332	4,317,668
TOTAL	**7,817,600**	**499,003**	**499,003**	**7,318,597**

* Total may not equal sum of components because of independent rounding.

Figure 1. *Location and approximate thickness of coal beds in Utah (from Doelling and Smith, 1982).*



Utah's high-quality coals generally developed in lagoons and swamps in deltaic lowlands protected by barrier beaches. To date, significant coal production has been achieved in at least five formations, listed here in order of importance: Blackhawk, Ferron-Frontier, Neslen, Dakota, and Straight Cliffs. All the coal produced in 1987 was mined from the first two.

The geology and depositional environments in the mining area are both extremely important in pre-mine planning and mining. Initially, coal geologists must study the depositional environments of the host rocks to predict and avoid the potentially costly problems attributable to geology. The geologists' information helps the mining engineers in developing trouble-free mining plans. For example, a relict channel sand cutting into, or diminishing, the thickness of a coal bed can have a devastating effect on the productivity of an advancing longwall system. Such studies also help eliminate or restrict areas with potential safety problems.

MINING METHODS AND COAL PRODUCTION

The geologic setting can be problematical in mining, but it is usually solvable; of more significance are the facts that Utah's coal is mined singularly from underground mines and after mining it generally must be transported some distance. These two aspects of the mining of Utah coal have a far greater impact than the geology.

It is noteworthy that the economics of longwall mining, specifically capitalization cost, generally requires long-term contracts and/or stability in the coal market. As an end user, public utilities must assure coal supplies well in advance.

Longwall mining is on the rise in Utah while mining by continuous miner is on the decline. Utah is ranked number one in the west and number five in the nation for the number of longwalls it has (total, 10); Utah Power & Light Company (UP&L) is ranked number 10 in the nation by having four longwall systems. UP&L's Wilberg/Cottonwood mine produced a record 3.1 million tons of coal in 1987 with a very impressive maximum per shift production. There were also 38 continuous miner units in operation in the coal fields of Utah, however, some were in operation only part of the time. The average annual production of each continuous miner unit amounted to 175 thousand tons, although Southern Utah Fuel Company and Soldier Creek's continuous miner units produced nearly twice the average.

Utah produced 9.9 million short tons of coal using nine longwall systems and 6.8 million short tons of coal with continuous miner units in 1987. This is in contrast to coal production in 1986, when only 6.6 million short tons were produced with 10 longwall systems and 8.0 million short tons with continuous miner units.

PRODUCTIVITY

The level of production during 1987 was arguably the most significant in the entire 100-year history of coal production in the state of Utah. Even though net production in 1987 did not reach the record 16.9 million tons established in 1982, last year's production was clearly less speculative than that of the record year. All the 1987 production plus almost half a million

Table 3. *Historical production, distribution, consumption, number of employees and mines, coal price and the value of coal produced in Utah (Values, where applicable, are in thousand short tons).*

	YEAR	1980	1981	1982	1983	1984	1985	1986	1987	1988~
1	Production	13,236	13,808	16,912	11,829	12,259	12,831	14,269	16,521	18,291
2	Distribution	13,014	14,627	15,397	12,188	12,074	14,361	13,243	16,989	18,191
3	Electric Utility Outside Utah	3,357	2,688	3,643	3,404	3,730	3,746	2,989	3,182	3,200
4	Electric Utility In Utah	5,224	4,829	6,134	5,219	4,688	7,191	6,955	11,677^	12,600
5	Coke Plant Outside Utah	798	779	859	—	—	—	—	—	—
6	Coke Plant In Utah	318	267	137	32	162	39	484	291^	1,200
7	Other Industry Outside Utah	1,536	1,645	1,349	1,091	1,542	1,866	1,745	1,813	1,900
8	Other Industry In Utah	360	494	728	582	465	352	270	349^	540
9	Residential/Commercial Outside Utah	261	180	233	292	311	312	81	83	90
10	Residential/Commercial In Utah	237	197	177	191	258	252	192	204	230
11	Export	776	3,472	2,177	1,346	849	625	551	555	731
12	Import	1,215	1,136	797	937	1,539	1,580	1,145	1,165^	2,300
13	Number of Coal Operators	16	16	16	15	15	15	16*	16	16
14	Active Mines	29	28	29	25	24	22	21	20	19
15	Employed at the Mine	3,512	4,166	4,296	2,707	2,525	2,563	2,881	2,650	2,944
16	Production/Man Hour	1.96	1.99	2.05	2.59	2.94	2.80	3.08	3.25	3.31
17	Average Price $/Ton	$25.63	$26.87	$29.42	$28.32	$29.20	$27.69	$27.64	$25.26**	$26.76
18	Coal Value (10^6)	$339	$371	$498	$335	$358	$355	$394	$417	$489

~ 1988 figures are forecast.

^ There were 1,165,000 tons of coal imported into Utah: 905,000 tons used at DG&T, 160,000 tons at Geneva, & 100,000 other industrial uses.

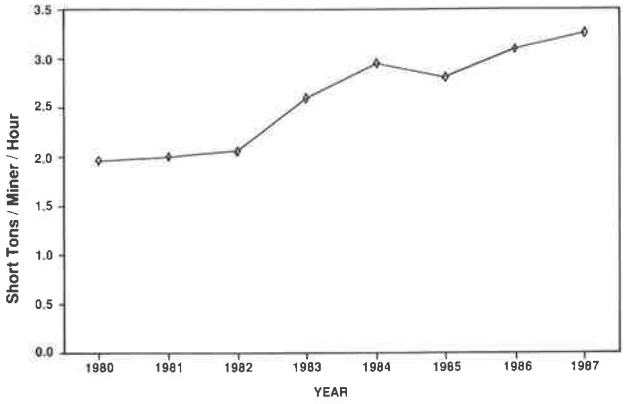
** New mine opened in December 1986 in Summit County.*

*** In 1987 prices were generally lower due to higher efficiency achieved by UP&L and a very competitive spot market.*

tons from the stock pile were used, and the level of distribution rose to 17 million tons. The production level in 1982 was influenced by the 3.5 million tons of coal exports in 1981. Because the export market failed to develop as expected, the level of distribution of 1982 (15.4 million tons) was over one and one-half million tons below that of production; consequently, net production in 1983 fell to 11.8 million tons which was the lowest level of production in this decade (table 3).

The average productivity in all Utah mines was about 26 tons per man shift or 3.25 tons per man hour. This is more than five percent higher than the level of productivity reached in 1986 and the highest ever achieved in Utah (figure 2).

Figure 2. Productivity in Utah mines.



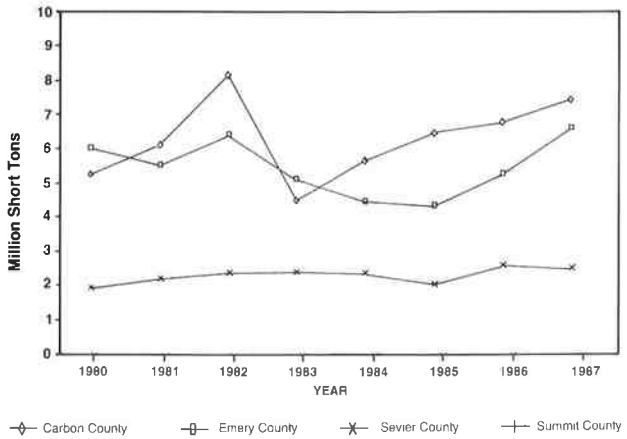
PRODUCTION

Utah coal miners produced 16.7 million short tons of low sulfur bituminous coal from 20 mines in 1987. This gross tonnage is exceeded only by coal production in 1982, when 28 mines produced the all-time Utah annual record 17.3 million short tons of coal. The average mine price of the coal was $25.26 which gives the 1987 net coal production of 16.5 million tons a total value of $417 million.

Production by County

Production by county from the end of 1980 to the end of 1987 is depicted in figure 3. The decline in Carbon County's 1983 production from a number of Book Cliffs mines was a result of overproduction in 1982. However, both Carbon and Emery counties show increasing trends, while the production from Sevier County remains somewhat constant. Minor production is shown for Summit County.

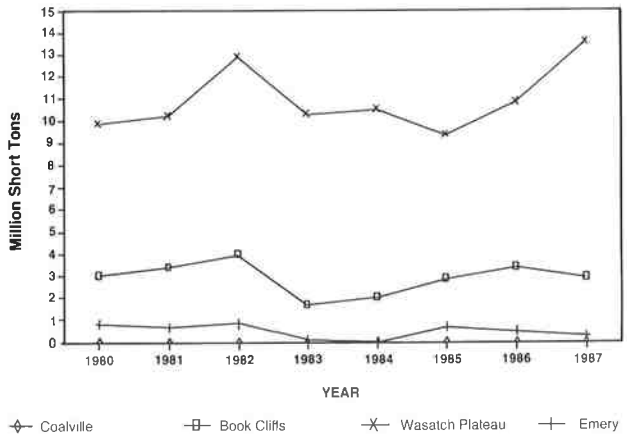
Figure 3. Utah coal production by county.



Production by Coal Field

Production by coal field shows an increasing trend for the Wasatch Plateau over the past two years (figure 4). This trend will probably continue because of the number of captive mines, in addition to non-captive mines, in the Wasatch Plateau that are furnishing coal for the Intermountain Power Project (IPP). Three mining complexes in the Book Cliffs are no longer captive mines and must compete on the open market. The Emery field shows a very steady but low production, and the Coalville field has just resumed minor production.

Figure 4. Utah Coal Production by Coal Field



Production by Land Ownership

Production on federal land has been on the rise over the past four years both by amounts produced and as a percentage of the total production (table 4 and figure 5). On the other hand, production on fee land has been on the decline both as a percent of the total production and tonnage. Production from state land has been, on the average, about one-half million tons over the past three years.

Table 4.
Historical coal production in Utah by land ownership (values where applicable are in thousand short tons).

Year	Total	Federal Land Amount	%	State Land Amount	%	Fee Land Amount	%
1984	12,259	8,096	66%	281	2%	3,882	32%
1985	12,831	9,178	72%	510	4%	3,143	24%
1986	14,269	11,075	78%	502	4%	2,692	18%
1987	16,521	13,343	81%	488	3%	2,690	16%
1988*	18,291	15,200	83%	350	2%	2,741	15%

**Forecast*

DISTRIBUTION TO OTHER STATES

During 1987, Utah shipped a total of 5.1 million tons of coal to 14 other states. The major purchasers were Nevada and California. Nevada bought more coal from Utah than the other 13 states combined (table 5).

Nevada, with 2.6 million tons of purchase, was by far the main electric-utility coal user. California, with 1.8 million tons of purchase, was the biggest industrial coal user. Arizona and Colorado, with slightly less than 200,000 tons of coal purchase, were followed by Idaho, Montana, Washington and Wyoming, with less than 100,000 tons of coal purchase each. Indiana, Iowa, Mississippi, Nebraska, Virginia, and Wisconsin also bought small amounts of Utah coal.

Even though the electric-utility coal sales to Arizona and Colorado are small in comparison with those of Nevada, they are suggestive of the revival of a substantial amount of electric-utility coal sold to states other than Nevada, which was the situation that Utah enjoyed a few years ago.

Table 5.
Distribution of 1987 Utah coal to other states (values are in thousand short tons).

State	Electric Utility	Other Industrial	Residential/ Commercial	Total
Arizona	122	72	0	194
California ~	341	1,493	*	1,834
Colorado	128	55	2	185
Idaho	0	28	21	49
Indiana	*	0	0	*
Iowa	0	0	*	*
Mississippi	*	0	0	*
Montana	0	5	*	5
Nebraska	0	*	0	*
Nevada	2,525	107	2	2,634
Virginia	0	0	*	*
Washington	0	22	44	66
Wisconsin	0	*	0	*
Wyoming	0	21	0	21
EIA Adjusted Total	3,116	1,803	69	4,988
From Table 3.	3,182	1,813	83	5,078

~ Energy Information Administration (EIA) report considers the sale to the Cool Water Plant in California as other industrial rather than electric utility coal because the coal is gassified first.

**Amounts less than 1,000 short tons*

DISTRIBUTION IN UTAH

Forty-four percent of the total coal produced in Utah in 1986 was used for Utah power generation, and that figure rose to 65 percent in 1987. UP&L produced 5.7 million tons of coal for its own consumption, which was 40 percent more than the 1986 production of 4.1 million tons. Deer Creek produced 2.5 million tons of coal, of which 2.4 million tons was transferred by conveyor belt to point of consumption, the Huntington plant. The remaining 0.1 million tons was transferred to the Wilberg/Cottonwood mine by an in-mine conveyor belt, to be further transported by truck along with the 3.1 million tons of Wilberg/Cottonwood production to the Hunter plant. In addition, UP&L purchased about one-half million tons of coal for use by its Carbon plant.

IPP's purchase of 4.6 million tons of coal was 259 percent of its 1986 purchase of 1.8 million tons. This increase in consumption is explained by the start-up and on-line status of the second unit which was dedicated on June 13, 1987. Nearly 3.8 million tons of the total coal purchased by IPP was under a long-term contract with five Utah coal operators. The remaining 0.8 million tons of coal purchased was from five other coal operators on the spot market in a very competitive environment. During 1987 IPP purchased 17 percent of its coal on the spot market. IPP could go up to 25 percent without greatly affecting the spot market. However, if higher percentages of spot purchases are contemplated, the effect on spot coal prices may be such that the economic advantage of spot purchase will diminish significantly.

Deseret Generation and Transmission's (DG&T) Bonanza plant near Vernal used over 0.9 million tons of coal, and its coal consumption will surpass 1.2 million tons in the current year.

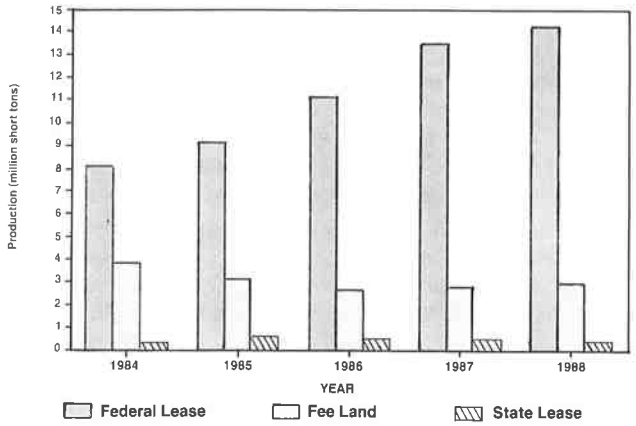
During 1988, UP&L will use about 6.0 million tons of coal, which is about seven percent more than in 1987. The main reason for this growth of coal usage and consequently generation of electricity is the increased sale to the out-of-state customers who are experiencing adverse regional weather and lower hydroelectric generation and, to a lesser extent, because of a higher rate of consumption within the state of Utah.

Of IPP's 4.6 million-ton coal purchase during 1987, 0.6 million tons were used to increase its coal stock to 1.2 million tons. At the present rate of operation, this stock level is adequate for 100 days. Since IPP's coal stock has been built to the desired level, it anticipates that its purchase of coal for 1988 will be limited to generation of electricity and could go as high as 4.8 million tons. The total consumption of electric-utility coal for 1988 is forecast to be 12.6 million tons.

During 1987, about 0.3 million tons of metallurgical coal were used in Utah. One hundred thirty-one thousand tons came from Utah; the remainder was imported into Utah from Colorado. In 1988, Basic Manufacturing and Technology of Utah, Inc. (BMT) will use 1.2 million tons of coal. Fifty-eight percent or 0.70 million tons will be purchased from Mid-Continent Resources, Incorporated of Carbondale, Colorado. The Carbondale coal is a medium-volatile coal. Coal for this end use might also be obtained from the Somerset mine and from other sources on both sides of our eastern border. The remaining forty-two percent or 0.50 million tons of high volatile coal will come from Utah and other eastern states such as Kentucky.

Between 1983 and 1986, the consumption of industrial coal in Utah declined, reaching the lowest point of the decade. In 1987, consumption rose to 0.35 million tons, and in 1988

Figure 5. Coal production and land management.



consumption is projected to increase dramatically to 0.54 million tons, mostly as a result of increased consumption by Kennecott Copper Company. Kennecott's consumption of just over 0.1 million tons in 1987 should at least triple in 1988. This dramatic rise in consumption of industrial coal is notwithstanding the permanent closure of the Lone Star Cement plant, formerly known as Portland Cement Company of Utah, which annually used over 77,000 tons of coal to produce 1.1 million tons of cement. Other industrial users will use more coal as the so-called "gas bubble" deflates and industrial gas prices begin to rise.

Utah's residential and commercial coal consumption has averaged about 0.21 million tons over the past decade; in 1987 it held that level of consumption even though that amount was almost 30 percent higher than the consumption in 1986. Nevertheless, in the future, residential and commercial consumption should increase moderately as a result of the lower cost of coal per million Btu of delivered heat in comparison with wood, natural gas, or heating oil. The price of natural gas and heating oil will begin to rise as early as the end of this year, unless the overproduction by some of the OPEC members compels Saudi Arabia to take similar punitive action as in 1986 causing a plunge in world oil prices. However, this would be a temporary measure and prices would go up again. The price of coal, on the other hand, remains steady or increases at a much slower rate per million Btu delivered. As a result of this divergent price increase, the consumption of coal as a heating source should become attractive to residential and commercial users. Consequently, this type of coal consumption should increase by at least seven percent per year over the next three years.

IMPORTS TO UTAH

The importation of coal into Utah is on the rise and most likely will continue. The coal is imported from Colorado to the Bonanza plant of the Deseret Generation and Transmission

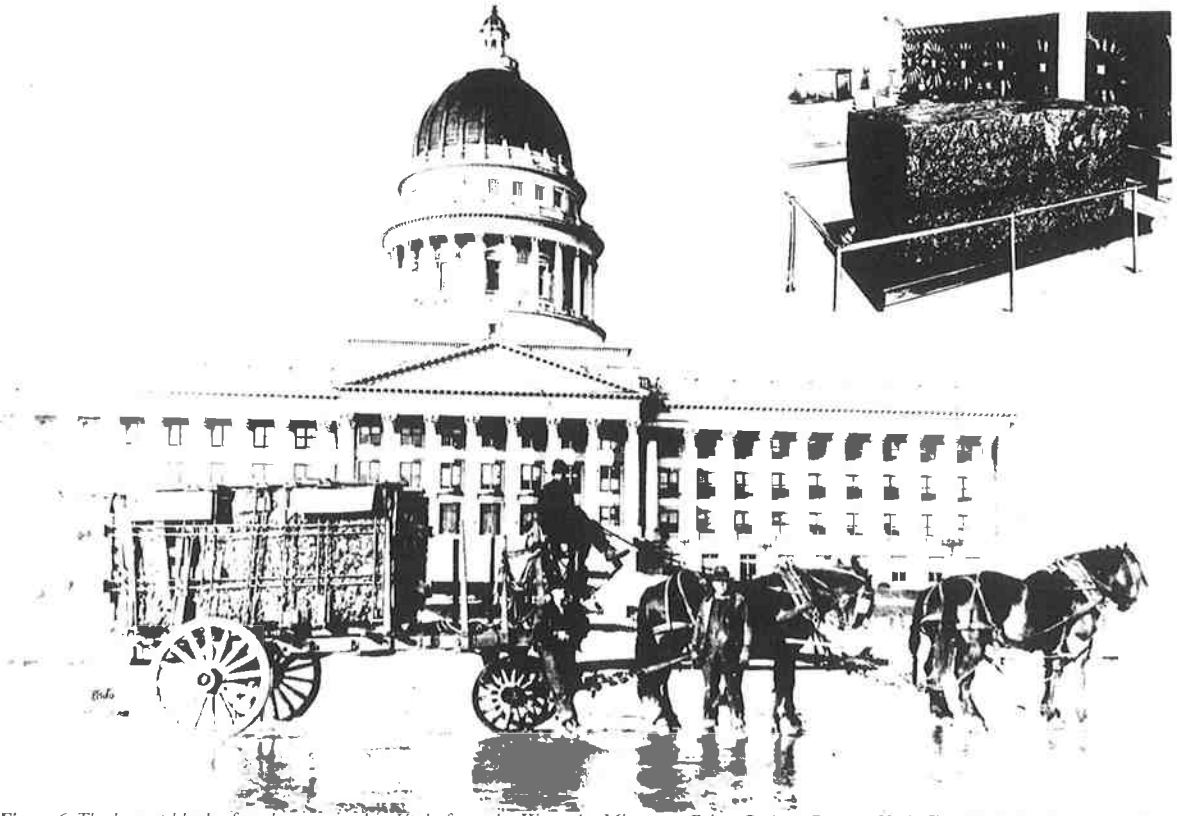


Figure 6. The largest block of coal ever mined in Utah, from the Hiawatha Mine near Price, Carbon County, Utah. Hauled to the State Capitol Building about 1920, it was displayed for about 40 years in the basement (inset photo). Photographs courtesy of Utah State Historical Society and H.H. Doelling.

Company, a convenient 36 miles away. In 1987 the amount of imported coal was 0.91 million tons, which should increase to 1.2 million tons in 1988.

Another category of imported coal is coking coal. Medium-volatile coal from Mid-Continent Resources, Inc. of Carbondale, Colorado, is brought to BMT's Geneva Works to be mixed with the high-volatile coal from Utah and other eastern states. Historically, this use has been about 1.2 million tons per year, but it was reduced to 0.16 million tons in 1987 when United States Steel Corp. (USX) idled the Geneva Steel and finally sold it to BMT of Utah. This type of consumption should rise to 1.0 million tons in 1988.

Utah also imported about 0.1 million tons of industrial coal, mostly from Wyoming but some from Colorado; it is expected that this trend will continue without much change.

In total, Utah will import about 2.3 million tons of coal from Colorado and Wyoming in 1988.

EXPORTS ABROAD

Plateau Mining Company is about the only company that exports Utah coal outside of the continental United States. Historically, the export market has been very competitive. With South African coal and Australian coal on the market, it has been very difficult to secure contracts in the Pacific Rim or Europe. Now with Columbian and Venezuelan coal coming to the export market and the Chinese trying to enter, it has become even more difficult to compete on the world's coal market.

Two aspects have kept the door to the export market ajar for Utah. One is the precipitous fall of the dollar in relation to most currencies, and the other is the affinity of the Taiwanese for American coal. In 1988 about 0.73 million tons of coal should be exported from Utah, most of which will be steam coal going to Taiwan.

Under present conditions, Utah should look to the west for its market. Anything to the east could be served by Colorado with similar types of coal and minemouth prices, but with the advantage of being about 500 railroad miles closer to the eastern market. This translates to about $10 in transportation costs per short ton of coal. Colorado and Wyoming markets can only be developed marginally, and only in areas that are closer to Utah's coal fields than to their own. Arizona and Idaho should be developed more as a market for Utah coal. Washington and Oregon could become a market if present conditions change. Markets in Nevada and California should be developed more vigorously because of their greater potential to purchase coal.

Utah coal will probably show considerable price reduction in 1987 compared with 1986, mostly because of greater efficiency and productivity realized by UP&L but partly because of the very competitive spot market, which had a tendency to push the coal prices even below variable cost.

Table 6 summarizes many aspects of the 1986 and 1987 gross coal production in Utah. The production is divided by county, coal fields, and mining methods. Table 7 reports the methods of transport by which the coal reached its destinations.

Table 6.
Gross coal production summary 1986 and 1987 (thousand short tons).

	1986	1987
Production	14,632.7	16,714.5
COUNTY		
Carbon	6,994.3	7,706.5
Emery	5,278.4	6,746.6
Sevier	2,360.0	2,228.0
Summit	0.0	33.4
COALFIELD		
Book Cliffs	3,360.4	2,885.3
Wasatch Plateau	10,769.3	13,526.9
Emery	503.0	268.9
Coalville	0.0	33.4
MINING METHOD		
Longwall units	10	9
Longwall Production	6,611.3	9,894.0
Continuous Miner Units	43	38
Continuous Miner Prod.	8,021.4	6,820.5

COAL OUTLOOK

Utah's coal future appears fairly promising, and the level of production should be much more stable than it has been over the past few years. Utah's consumption of its own coal will be around 12.3 million tons per year and should increase in future years. The sale of coal to other states should be about 5.0 million tons per year, and exports outside the continental United States should range between three-fourths and one million tons per year. This could go much higher if the export coal prices were to rise, which is not very likely, and if Utah coal producers try to take advantage of the renewed Japanese interest in Utah coal.

As long as socio-economic incentives to use Utah coal in Utah prevails, Utah appears to have a stable base for its underground-mined coal. However, to compete out of state in all end-use markets, the price gap that exists between Utah coal and other western-mined coal must be improved. Productivity in our underground mines has shown a continual rise,

Table 7.
Gross coal transportation summary 1986 and 1987 (thousand short tons)

TRANSPORT	Railroad	Truck	Other	Unspecified
1986	5,921.0	4,315.0	2,067.0	2,329.7
1987	8,339.0	5,347.0	3,028.5	0.0

which should help both Utah coal use in Utah and the price gap. But, to be more competitive with other coal states, Utah must continue to raise the level of productivity in its underground mines and be much more aggressive and more innovative toward rate mitigation and less costly approaches to transportation.

Industrial coal sales to California are always under pressure from imported coal. Canada, Australia, and even China are competing against Utah coal in California, but the threat is not as serious as it may seem. In this sale, the coal industry has an implied partnership with the railroad industry, and any loss of industrial coal sales to California would impact one just as much as the other. Because of this implied partnership, a possible rate reduction by railroad industry could keep the industrial coal sale to California competitive with the imported coal.

It is both noteworthy and a dilemma that Utah has undeveloped low-sulfur, high-Btu surface coal in the Emery, Alton, and Henry Mountain coal fields. The lack of suitable roads and transportation systems to move the coal to market, among other deterrents, impedes its development. This surface-minable coal could easily be competitively extracted against other western states' surface-mined coals, but it would also underprice the Utah underground coal mines, thus creating the dilemma.

Table 8 shows Utah coal to have about the best general sulfur content versus Btu/lb ratio compared with coals from other major producing states. The exact quality of the coal, of course, varies from mine to mine and from seam to seam. The coal quality partly compensates for the higher transportation costs that Utah incurs in moving its coal to market. This compensation would improve markedly if the politically motivated "best available control technology" (BACT) were modified to allow untreated low-sulfur Utah coal to be burned in power plants. When burned, untreated Utah coal produces less harmful matter than most other higher sulfur coals using BACT.

REFERENCES

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Table 8.
Comparison of sulfur content for various coal producing states

Rank	State	Percent Sulfur By Weight	Average Btu per Pound	lbs. of SO_2 Per Million Btu Input
1	Colorado	0.42	10,711	0.784
2	Utah	0.48	11,617	0.826
3	Wyoming	0.40	8,686	0.921
4	Montana	0.53	9,024	1.175
5	Tennessee	1.30	12,492	2.081
6	Alabama	1.36	12,284	2.214
7	West Virginia	1.54	12,561	2.452
8	Pennsylvania	1.80	12,371	2.910
9	Kentucky	1.77	12,118	2.921
10	Illinois	2.59	11,113	4.661
11	Indiana	2.62	11,102	4.720
12	Ohio	3.21	11,741	5.468