

John N. Hoffman
SMITHSONIAN INSTITUTION

**PENNSYLVANIA'S BITUMINOUS
COAL INDUSTRY:
AN INDUSTRY REVIEW***

THE BITUMINOUS coal field in Pennsylvania covers most of western Pennsylvania, extending from the southwest corner northward almost to Lake Erie, eastward to the Allegheny front, and northeastward through the north-central counties of the state to the southern boundary of New York. About 14,200 square miles are included in this field which forms the northeastern end of the Appalachian coal region, which in turn is a part of the eastern coal province.

The boundary of the coal field is extremely irregular. On the north, the boundary runs from the northwest corner of Crawford County across Warren and McKean to Potter and Clinton counties, then extends as outlying patches into Tioga, Bradford, and Lycoming counties. From Clinton County, the boundary follows the Allegheny front southward through Centre County, and between Cambria and Blair, and Somerset and Bedford counties. East of this line lies the Broad Top field in Huntington, Bedford, and Blair counties lying about thirty miles east of the main field and covering an area of about fifty square miles.

The coal measures are folded into many anticlines and synclines extending in a general northeast-southwest direction. The folding becomes greater as it progresses eastward; so we find that the beds in the western portion of the state are only slightly folded and the sides dip slightly.

The coal beds are of the Carboniferous Age (more than 250 million years old) and belong to the Pennsylvanian and Permian systems. The Pennsylvania system is again divided into the Monongahela, Conemaugh, Allegheny, and Pottsville series, with the Permian system including the Dunkard series. The coal measures usually occur in descending order: sandstone, shale, coal, clay, limestone, and sandstone.

*The following paper is one of a group summarizing the development of specific Pennsylvania industries presented on 18 June 1977 at the Rose Hill Seminar.

There are forty-two coal beds located in Pennsylvania with the most common ones being: Pittsburgh; Freeport (upper and lower); Kittanning (upper, middle, and lower); Brookville; Redstone; and Clarion. The total thickness of the coal measures in the western part of the state is between 2,600 and 3,000 feet. The most important seams belong to the Monongahela and Allegheny series but beds of various thickness are found throughout the measures and no series can be termed entirely barren of coal. As has been the case since the beginning of the industry, the thick beds are the most important commercial seams.

The first estimate of bituminous coal reserves in the state was made by M. R. Campbell of the United States Geological Survey. His report stated that the 14,200 square miles of bituminous coal area originally contained 112.7 billion tons. He further estimated that the supply remaining unmined at the close of 1907 was 109.8 billion short tons, or 492 times the production of that year.¹

During 1921, the Pennsylvania Geological Survey began an investigation to determine more accurately the quantity and quality of Pennsylvania's bituminous coal resources. The original work was done by John F. Reese, with some later revision by James P. Sisler. The Reese and Sisler report was published in 1928 and stated that the original reserves of bituminous coal were 75,093 million short tons.²

During the years 1950 to 1952 the United States Bureau of Mines investigated the known recoverable reserves of coking coal in various counties in Pennsylvania and these calculations showed reserves considerably less than the Reese and Sisler estimates. The decrease in estimated reserves is due for the most part to the fact that Dowd and others included measured and indicated reserves in a relatively small area, whereas Reese and Sisler included all classes of reserves in a relatively larger area.

The low estimate by Reese and Sisler is partly the result of the use of a lower than average specific gravity for the coal in the state. Although the Reese and Sisler estimate is unduly conservative, the fact that no new complete estimate for the coal reserves of Pennsylvania is available justifies the continued use of their estimate without revision as shown in the 1972 *Mineral's Yearbook*.

Two later estimates have been prepared: one by the U.S. Geological Survey in 1973³ and the other by the U.S. Bureau of Mines in 1974.⁴

1. M. R. Campbell, "Mineral Resources of the United States", *U.S. Geological Survey*, bulletin 394, 1909.

2. J. F. Reese and J. D. Sisler, "Bituminous Coal Fields in Pennsylvania", *Pennsylvania Topographic and Geologic Survey*, Harrisburg, Pennsylvania, 4th series, bulletin M-6. Part III, 1928.

Both of these estimates are considerably lower in total reserves for the state but again the estimates are limited by available data and differences in assumptions for quantity and thickness of coal seams surveyed. The reserve base still concludes that Pennsylvania has remaining approximately 200 years supply.

THE BEGINNING

The early beginnings of coal was researched and documented by H. N. Eavenson in 1942,³ but several significant historical facts as they pertain to the beginnings of coal mining in Pennsylvania have been selected for mention in this paper.

The earliest suggestion that coal might be found in Pennsylvania was made by Gabriel Thomas in 1698. Thomas wrote an account of "Pennsylvania" which was dedicated to William Penn. He mentioned seven kinds of stone including "Iron Oar," and after mentioning copper and mineral waters, says, "I have reason to believe there are good coals also, for I observed, the runs of water have the same coloring as that which proceeds from the coal-mines in Wales."

The earliest map of coal's occurrence in Pennsylvania is found in a map published in Hanna's "Wilderness Trail" where he calls it, "A Trader's Map of the Ohio County Before 1753." This map appears to have been made by John Pattin, an Indian trader, who made many voyages into the area. We cannot be certain that Pattin actually saw the coal deposits, as he may have received the report from other traders.

The first record of coal in the western region of Pennsylvania is that of the Pittsburgh seam. When Washington led his expedition across the Allegheny Mountains in 1754 his second in command was Captain Adam Stephen. In a letter dated from Great Meadow, 26 May, after he had returned from an expedition along the Monongahela River, he reported, "Nature seems to have furnished this country in the most lavish manner with all the conveniences, and comforts of life. I have seen a deal of limestone, coal, and such, iron ore, all convenient for water carriage." According to Eavenson, the first map showing a coal mine was by B. Raber in 1761, on a "Plan of Fort Pitt and Points Adjacent." The mine was on Coal Hill just opposite the point.

3. P. Averitt, "Coal Chapter in United States Mineral Resources", *U.S. Geological Survey*, paper 820 (1923), pp. 133-142.

4. U.S. Bureau of Mines; "Reserve Base of Bituminous and Anthracite for Underground Mining in the Eastern United States," *Information Circular 8655* (1974).

5. Eavenson, Howard N.: *The First Quarter and a Century of American Coal Industry*, (Pittsburgh, Pa., 1942).

George Washington in his journal of "A Tour to the Ohio River" in 1770 made the following entry: "October 14th. At Capt. Crawford's all day. Went to see a coal mine not far from his house on the bank of the river. The coal seemed to be of the very best kind burning freely and abundance of it." Capt. Crawford lived in the heart of the Connellsville region, and Washington's assessment was exceedingly accurate.

Two months following the purchase of lands from the Indians in November 1768, John Penn directed the surveyor general "to cause to be encouraged for our use the quantity of five thousand acres of land about Pittsburg to include the fort and the coal mine opposite or nearly opposite the fort in the other side of the river." This area was laid out in lots and opened for settlement and development in 1784. It was Penn's intention not to develop the area himself, but to lease the greatest part to others.

According to present day operations, the quantity of coal used during the early settlement in western Pennsylvania was very small but apparently badly needed for the manufacture of small munitions needed during those primitive days.

After the close of the Revolution, settlers began to pour over the mountains to settle the western areas of the state. With the growth of population the interest in coal greatly increased, and it was not long before the production of coal west of the mountains was larger than east of them.

On 7 February 1789, the Pittsburgh *Gazette* reported "that a large keel boat belonging to John McDonald of this town loaded with coal, coming down the Monongahela River on Saturday evening last, unfortunately sank by which accident four persons were drowned."

When coal began moving down the Ohio River is not known, but it would appear that on 27 January 1793, acting deputy quartermaster, Isaac Craig sent fifty bushels of coal on a small keel boat to Fort Washington (now Cincinnati).

The first actual workings of the pits along Coal Hill were recorded by Victor Collot, a French engineer, who made a survey of the Ohio and Mississippi rivers in 1796. He made the following comments about Pittsburgh.⁶

"A rich vein of coal is found on the summit of one of the mountains which bounds the Ohio on the left.

The quality of this coal is equal to the best in England. It costs less than four pence per bushel.

6. Collot, Victor; *A Journey in North America*, (1796), 1:38-39.

Yearly production of bituminous coal in the western Pennsylvania area has been estimated at 20,000 tons prior to 1790. By the year 1805 when Pittsburgh seam production reached 100,000 tons annually in Allegheny, Fayette, Washington, and Westmoreland counties, production started in Clearfield County.

The coal industry grew steadily in the following years and mines were opened in many places not only along the river but wherever a local demand existed. The Washington (Pa.) *Examiner* in March 1826 carried an advertisement of a sale of "meadow lands," on the road from Pittsburgh to the borough, and three miles from the latter, which had several banks now opened which furnished the principal supply to the borough of Washington and the surrounding county.⁷

It is always the case with heavy and cheap materials that the area within which they can be economically used depends upon the cheapness of transportation. In the early days of the coal industry with poor roads and wagon transport, coal could only be moved a few miles from the mine by any other means than water routes. The building of turnpikes was an early national project, but the first turnpike over the Alleghenies only reached the Ohio River at Wheeling, Virginia in 1818.

By the 1820s the eastern states realized the inadequacies of turnpikes and turned their attention to the construction of canal systems that would bring traffic to their interior cities. The Erie Canal was opened in 1825 from Lake Erie to the Hudson River through the state of New York. The Pennsylvania Canal was opened in 1834 between Columbia and Pittsburgh and the connecting Pennsylvania and Ohio Canal to Akron, Ohio in 1838. This latter canal accelerated the movement of coal from not only around Pittsburgh but to adjoining principal markets.

Small railroads were in existence from the many mine openings to loading docks on the river, but it was not until the mid-1800s that heavy duty railroad connections were completed.

The Pennsylvania Senate investigated the coal industry in 1833, and with the assistance of the Pittsburgh newspapers were able to give the following estimates of the coal trade. The aggregate quality of coal used annually from the Pittsburgh area was 306,000 tons by an estimated population of 30,000. The state production for the same year was 504,540 tons.

Harris' 1837 *Pittsburg Directory* gives the first tabulation to show coal operators in the area.⁸ "There are nine coal railroads and twenty

7. *Washington (Penn.) Examiner*, 11 March 1826.

8. Harris, Isaac, *Pittsburgh Business Directory for the Year 1837*, p. 151.

teams, yearly amount to be mined and dispersed of the present year, 5,030,000 bushels at 5 cents per bushel is \$251,500—employs 375 hands and 120 horses.” His recapitulation lists nine glass factories, ten iron manufactures, and thirteen steam engines in operation.

The Secretary of the Commonwealth for Pennsylvania during 1838 collected statistics of agriculture, manufactures, and commerce. His report published after some delay provided the following information as the size of the bituminous coal industry in the state.⁹

Seventeen counties reported that 768 mines were active and produced slightly over 2 million tons of coal. The secretary commented that he knew this figure was most certainly less than the actual quantity mined due to the failure of some counties to perform their duties, but still the data represents the first official statistic showing the prominence of the coal industry.

MINING THE COAL

The early tonnages of coal in Pennsylvania were produced by very crude and simple methods. When the coal outcropped on the hillside, the citizen took a pick and shovel and filled his wheelbarrow with sufficient coal for his needs. If shafting was necessary, he dug a well down to the coal seam and hoisted his coal with crank and windlass. Before the invention of pumps, when the shaft accumulated too much water, he would dig another shaft.

Very early in the mining operation in the Pittsburgh seam, the miner started a systematic method of extracting coal from the nearly flat lying seams. The system was called the room and pillar system and was patterned after the “bord and pillar” system of Europe.

The basic procedure was to drive a main entry into the coal seam. From this main entry, headings were driven at right angles. From these headings and again at right angles rooms were driven. Blocks of coal called pillars were left standing between rooms to prevent the material overlying the coal from caving in on the working areas.

It naturally follows that as the main entry became longer, the miners’ work became more difficult and the wheelbarrow was replaced by animal drawn carts. Basically the miner’s work schedule in removing the coal from its natural environment took this sequence. Using his pick, the miner would break the coal from the coal seam and the broken lumps of coal would be loaded into his transport media.

The invention of the ‘miner’s squibb’ made it possible for the miner to use black powder to loosen the coal from the seam. The miner soon

9. *Pennsylvania House Journal*, volume 2, part 1, (1840), p. 29.

discovered that blasting off the solid was dangerous and produced too many fine sizes of coal. Then he began to undercut the face of the coal to obtain sufficient expansion area when the coal was blasted.

The work pattern now consisted of four steps: (1) undercutting; (2) drilling; (3) blasting; and (4) loading. It goes without saying that the occupation was strenuous and back breaking and output was low. Working in natural conditions, the miner always had to be alert to roof conditions and, depending on the character of the roof, was forced to timber his working area to protect his life.

Hand loading methods were the standard mining operation for the industry for many years until mechanical devices were invented to lessen his physical requirements. The following inventions contributed to modern continuous mining methods:

- 1877 cutting machines - air
- 1880 punchers - air
- 1882 locomotives - air
- 1887 locomotives - electric
- 1889 drills - air
- 1890 cutting machines - electric
- 1914 drills - electric
- 1916 pit car loaders
- 1917 crawler mounted loaders
- 1923 rubber belt conveyors
- 1938 shuttle cars
- 1941 tungsten carbide bits
- 1947 continuous miner

As not all coal deposits were adaptable to underground mining methods, surface stripping methods were begun for the seams that were located near the earth's surface. Surface mining became a reality with the invention of a full-revolving shovel by Otis in 1911.

Even with the introduction of many labor saving devices, the 1910-1920 period was still a decade of 100 per cent hand loading operations. Machine loading began in the 1920-1930 period and became effective in the next decade (1930-1940). Continuous mining began in the 1940-1950 period and was finally accepted by the industry between 1950 and 1960.

Miners' productivity expressed in tons per man per day remained low and in 1920 reached only 4.0. By 1960, with the gradual increase in mechanization, productivity had climbed to 6.0. However, the full impact of continuous mining was felt in the 1950 to 1960 period, and at the end of the decade, productivity had reached 10.7 tons per man

per day. With continuous mining methods becoming more sophisticated, productivity reached 13.68 tons by 1974.

In 1909, there were 185,921 miners employed in the Pennsylvania bituminous coal industry and at the end of 1960 their numbers had dwindled to 32,651. By the end of 1974 only 26,341 miners were employed in the state's bituminous coal industry.

HISTORICAL REVIEW OF PRODUCTION

Production statistics during 1840 were estimated by the United States Bureau of Mines to be approximately 465,000 net tons. Production data for earlier years were collected by Eavenson beginning in 1759 with an estimated production of 20,000 net tons, all mined from the Pittsburgh seam. Pennsylvania's share of the United States bituminous coal production was 42 per cent by 1850 when the nation's production reached 1 million tons.

The tonnage mined increased in most years between 1850 and 1900, and by the later date had reached 80 million tons annually. Growth of the industry continued at a rapid rate through 1907 when 150 million tons were produced. After 1907 there was a slowing down of the growth rate, but in 1918 a record production of 178 million tons were recorded. Since that peak obtained during World War I, the trend of production has been downward and even during the great industrial activity in 1929 production only reached 144 million tons.

Notable exception to the downward trend of production occurred during World War II and the Korean police action. The resurgence in coal production that occurred during the war years was followed by periods of sharply dwindling activity. Even with the energy shortages created by the oil embargo during 1973 and 1974, Pennsylvania's annual production remained about 80 million tons. Pennsylvania's share of total United States coal production in 1974 was 13.3 per cent.

In summary the following conclusions can be made of the conditions of the Commonwealth's coal industry.

1. Pennsylvania dominated the U.S. bituminous coal industry during the early years and as late as 1915 was still contributing approximately one-third of the coal to the nation's users. The Interstate Commerce Commission developed a freight rate situation that favored the development of natural resources, mainly coal in areas far removed from industrial centers. With this ruling, the infant Southern coal industry was expanded and led to the entrance into

many areas that were once the markets for Pennsylvania coal.

2. High coal prices and a high level of wages during World War I caused the opening of small mines in great numbers in all fields thus diminishing Pennsylvania's share of the nation's production. This indicates that Pennsylvania, although raising its number of operating mines, did not continue to maintain the high proportional share of total U.S. production. This expansion, however, did increase Pennsylvania productive capacity, in reality an overcapacity which to this day has continued to plague the state's industry.

3. Miner wages in the Southern coal fields were lower, and this fact coupled with the railroad rate advantage continued to decrease Pennsylvania's share of the nation's coal production during the 1920s. Actually by 1927, Pennsylvania coal mining was a distressed and disadvantaged industry. The wage differential was eliminated by the 1941 union contract which established a uniform structure of wages for the entire Appalachian region.

4. In 1975, Pennsylvania ranked third among coal producing states, with Kentucky first and West Virginia second. However in all-time production it still heads the list with over 9.4 billion tons coming from her mines.

NUMBERS OF MINES AND COMPANIES

Data are not available on the number of coal mines operating prior to 1909. Since that time annual returns have been provided by the U.S. Bureau of Mines. The number of mines in 1909 was 1,492 and by 1923 had increased to 3,637 with a peak of 5,448 attained in 1920. Following the peak of the 1920s, the total number of coal producing mines declined to 1,148 or a decrease of 68 per cent.

World War II brought about an increase in the number of mines in operation and during 1943, the total reached 1,834. Even though the increase indicated the return of the industry to more prosperous times the previous high point was never reached. Again during the Korean outbreak, the number of mines reached 1,932, but again the prosperity was short lived. The number of mines in Pennsylvania continued their pre-war decline and by 1974, the total reached a new low of 765.

Mines are classified into 6 categories depending on their annual tonnage. Class I, over 500,000 tons annually; class II, over 200,000 to 499,999 tons annually; class III, 100,000 to 199,999 tons annually; class IV, 50,000 to 99,999 tons annually; class V, 10,000 to 49,999 tons annually; and class VI, 1,000 to 10,000 tons annually.

Four major trends are generally discernible: 1. a marked expansion

of the industry from 1909 to 1923; 2. a decline from 1923 to 1933; 3. a recovery between 1933 and 1950; and 4. a decline from 1950 to the present.

A comparison of 1933 and 1974 when the state's annual bituminous coal production was about equal (80 million net tons), the changes in the size of operating mines becomes more clear. For the same period, it is interesting to note that in 1933, the state was responsible for approximately 24 per cent of the total United States production, while by 1974, the state's share had dropped to 13.3 per cent.

Class I mines increased slightly in number with an accompanying increase of 9 per cent of the total production. Class II mines dropped from 83 to 45 with a corresponding production decrease of 15 per cent. Class III mines dropped from 92 to 41 with a decrease of 9 per cent in production. Class IV mines increased from 123 to 210 with a net gain of 8 per cent. Class V mines increased from 291 to 534 with a production increase of 9 per cent. Class VI mines decreased in number from 525 to 192 with a one percentage drop in production.

Several trends in the changing patterns in the various classes of mines are apparent. The most important is the steady increase in the miner's productivity as a result of increased mechanization programs. The changes in the middle-sized mines probably were due to the shrinkage of coal markets. Likewise, the decrease in the number of small mines indicates that their local markets were being lost to other energy forms. However, these small operations may be restored to active operation with small capital requirements.

If complete data were available to consider the number of coal mining companies operating in the state, it naturally would parallel the decreases observed in the number of mines operating. According to Tyron, Metcalf and Rogers, the total number of operating companies in the United States for the following years were: 1895-2,230; 1905-3,484; 1920-6,277; and 1929-4,612.¹⁰

The total number of companies operating in Pennsylvania is not available for any long period of years, but selected years indicate that during 1903, 500 companies were operating; by 1910, the total reached 1,800; in 1940 only 900 were recorded; and by 1958, the total was 750. According to the 1976 edition of the *Keystone Industry Manual* there were about 280 coal mining companies in Pennsylvania.

10. F. G. Tyron, R. C. Metcalf, and H. O. Rogers, "Drastic Liquidation of Excess Capacity", *COAL AGE*, (February 1931): 79-81.

COAL MOVEMENTS

Bituminous coal produced in Pennsylvania has historically been shipped from the mines primarily by railroads. However, a considerable portion has been loaded on barges and shipped on inland waters to many consumers. During 1932, trucks became important in the transport of coal. Some of the state's production reaches the consumer by a combination of routes. The main combination routes have been the railroad-Great Lakes trade, and the railroad-tidewater routes.

In 1909 approximately 63 per cent of the state's production was shipped by rail, and 8 per cent by barge. Truck movements at that time were small and not reported separately, with the remaining 29 per cent being used locally for mine power and coke manufacture.

In 1932, truck movements were first reported separately in the *Mineral's Yearbook* and accounted for 1.4 per cent of the state's coal movements. In the same year, 81.4 per cent moved by railroad; 9.6 per cent by water; and the remaining 7.6 per cent was used locally.

In 1947, 66 per cent moved by railroad, 16.4 per cent by water, 11.2 per cent by truck, and 6.4 per cent was used locally. The downward trend for coal moved by rails continued, and by 1975, railroads showed 44 per cent, water 18.2 per cent, trucks 28.2 per cent, and local use 9.6 per cent. The increase in local use was caused by the trend to mine-mouth generating installations.

COAL MARKETS

Bituminous coal is classified according to the use to which it is put, as steam coal, domestic coal, or special-purpose coal. Steam coal, as the name implies, is used for steam raising purposes; domestic for household use; and special-purpose for the manufacture of gas and coke.

That Pennsylvania early became a large producer of bituminous coal can be partially explained by the development of large scale uses of coal within the state. At the beginning of the 20th century, some 38 per cent of the state's production was consumed within the state. By 1954 this amount had increased to 45 per cent and according to estimates for 1975 the state's share had climbed to 55 per cent. As this figure is a total state quantity, it doesn't reveal the ultimate specific use of the coal.

In the early days of the industry, it was normal to find that about 2 per cent of the production was used by the mines for power and heat. However, the companies found that using coal this way represented

a cost of production rather than a market for coal. Although some small tonnages are still consumed at the mines, the trend has been to shift to the purchase of power rather than the production of its own energy.

Another large market in the coal industry's beginning was local trade and during 1909 some 8 million tons went to this market. Since 1948 the quantity of coal entering this market has been difficult to isolate because of the change in reporting coal's usages. Today this market is combined in the annual reports with the quantity used by the beehive coke market and the tonnage of coal used at the mines. It probably is safe to assume that some 2 million tons reach these three end users.

PRODUCTION OF COKE

Although the production of coke does not represent the final use of coal, a significant change in this classification requires an explanation. The use of the by-product process of coke production has resulted in the transfer of a considerable portion of the coke industry to locations near markets for gas, coke, and the other by-products of the industry. In its infancy, the coke industry made no effort to save the by-products from the beehive ovens. It was the practice to ship coke rather than coal. In 1915 more than 20 per cent of the bituminous coal mined in Pennsylvania was made into coke at the mine. By 1929, the beehive oven process consumed only 5.1 per cent, and by 1975 accounted for less than one per cent of the state's production.

The shift from beehive to by-product coke production has had a most profound influence on the distribution pattern for Pennsylvania's bituminous coal. In the by-product method, coke ovens are generally adjunct to iron and steel plants, the coal being shipped from the mines to this operation. The by-product industry in Pennsylvania has grown rapidly, but not at a sufficient rate to offset the decline of the state's beehive coke industry.

In 1916 Pennsylvania provided 50 million tons to the nation's coke industry, which in that same year required 82 million tons. By 1929, the state's total dropped to 42 million tons, in 1946 to 25 million tons, and by 1958 down to 21 million tons. In 1975, the state's share had increased to 25 million tons with some 13 million tons being consumed within the state.

ELECTRIC POWER GENERATION

Electric utility power plants constitute the major outlet today for Pennsylvania's bituminous coal. Exact data of the long term trend of the consumption used by electric utilities are not available; however, there are sufficient data to show that the trend has been upward.

In 1917 approximately 2½ million tons of Pennsylvania bituminous coal entered the electric market. By 1919, this increased to slightly over 4 million tons; in 1946 to 6½ million tons; and in 1958 to 10 million tons. By 1975, the total consumption by the electric power industry had increased to 43 million tons, with approximately 29 million tons being consumed within the state.

It should be noted that in considering the change in the consumption pattern of bituminous coal for utility plants, that the generating efficiency has greatly improved. Therefore coal consumption has not increased as rapidly as the energy output. In 1919, it required 3.2 pounds of coal for one kilowatt hour of electricity generated. In 1927, it fell to 1.8, by 1946 to 1.3, and by 1958 to less than 0.90 pounds.

SUMMARY

Bituminous coal is basic to the economy of the state. The industry's prosperity or decline is naturally reflected in those areas where coal is king.

The coal industry is a very competitive business. As with any other commodity, quality and price are the major selling points. Most of Pennsylvania's coal industry competition is from mines in other Appalachian states, so transportation need not be a deterrent.

Coal's main competition has come from the entrance of cheap oil to east coast markets beginning in the 1950s. Despite the oil embargo of 1973-1974 and recurring natural gas shortages, the coal industry has not yet been able to fill the widening gap between supply and demand predicted for the nation's energy requirements.

Most utility plants are not willingly returning to coal, the most economic fuel, because of state and federal air pollution restrictions. One other segment of the coal industry that affects coal's position is the rising costs of producing coal due to a decline in miners' productivity. The productivity rate is decreasing since the implementation of the federal coal mine health and safety act in 1970.

Coal's hope for the future is that the increase of competitive energy resources will be greater than the increase in coal's cost, and it will remain the cheapest source for the nation's energy program.