# Coal in Pennsylvania

*recent developments and prospects*

A REPORT

of the

PANEL OF TECHNICAL ADVISORS ON COAL MARKETING

to the

JOINT STATE GOVERNMENT COMMISSION

General Assembly of the Commonwealth of Pennsylvania

1963

The Joint State Government Commission was created by Act of 1937, July 1, P. L. 2460, as last amended 1959, December 8, P. L. 1740, as a continuing agency for the development of facts and recommendations on all phases of government for the use of the General Assembly.

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# LETTER OF TRANSMITTAL

*To the Members of the General Assembly of the Commonwealth of Pennsylvania:*

House Resolution No. 33, Session of 1962, directs the Joint State Government Commission ". . . to inquire into and collect all of the information available relating to the coal industry with particular reference to plans or suggestions for new uses of coal, including the direct extraction of energy from it, new mining methods, and the availability of new markets for coal . . ."

In pursuance of this directive, the Joint State Government Commission in July 1962, appointed a technical panel consisting of experts in the various phases of coal mining, coal preparation and coal marketing. The Commission invited these experts to prepare a set of recommendations which if favorably acted upon would improve the economic position of Pennsylvania's mining industries.

I have the honor to transmit the recommendations of the Panel of Technical Advisors together with a brief statement prepared by the panel which sketches the recent developments and outlines the prospects of Pennsylvania's coal industries, both bituminous and anthracite.

BAKER ROYER, *Chairman*

*Joint State Government Commission*
*Capitol Building*
*Harrisburg, Pennsylvania*
*February 1963*

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Part 1

# A COAL POLICY FOR PENNSYLVANIA

*The Recommendations of the Panel of Technical Advisors*

The panel recommends that:

(1) All contemplated legislative action with regard to mining, acid mine waters, conservation and land use, be examined in terms of its impact on the production cost of coal in order to assure an ample supply of low cost electrical energy within the Commonwealth at all times.

(2) The legislature examine the Commonwealth's property, production, and income tax structures in terms of their effects on coal and pursue a course that will improve the competitive position of coal.

(3) The legislature encourage the development and use of the most economical transportation system or systems in order to facilitate shipment of Pennsylvania-produced coal to existing and potential markets.

(4) The legislature take measures calculated to remove discriminatory freight rates which currently impede the free flow of Pennsylvania coal in domestic and foreign markets.

(5) The Commonwealth enter into compacts with other coal-producing states to formulate policies designed to enhance the economic position of coal.

(6) The legislature initiate:

(a) Investigations calculated to ascertain the possibilities of hydraulic mining and hydraulic transportation of coal within the mine in those areas, such as the anthracite region, where excess water is a problem;

(b) Continuous studies of ways of eliminating mine disasters due to explosion, flooding and other causes.

(7) The legislature encourage through tax advantages and other suitable means, the building of a plant in one of the coal-producing areas for the purpose of ascertaining the possibilities of coal as a raw material.

(8) The legislature provide funds for:

(a) Continuous intensive research devoted to searching analyses of the constitution of Pennsylvania coals, their characterization, and their possible new uses when subjected to special treatments, particularly physical treatments, to separate the coal into fractions with different properties;

(b) Research to develop mining recovery methods that would facilitate economical recovery of that portion of coal (currently 50 percent in many seams) which is not recoverable by present mining methods and, hence, irreparably lost;

(c) Renewed investigations of the underground gasification of coal, using recently developed technologies. For example, an experimental small underground atomic blast in cooperation with the AEC might be planned. Underground gasification offers many attractive features, because it eliminates the handling of materials underground and delivers the coal energy to the surface in a convenient reactive form;

(d) Increased sustained research into the metallurgical uses of coal to preserve the use of coke when possible and to assure the use of coal in iron and steel manufacture as new refining technology becomes available;

(e) Work on the production of synthetic liquid and gaseous fuels from Pennsylvania coal;

(f) Expanded research on the combustion of coal in boilers, both for industry and utilities, to recapture the industrial market and protect the utility market;

(g) Investigating the methods of burning coal in slurry form to make it possible to adjust to any growth in pipeline delivery of coal;

(h) Continued research to find an economical solution to the water problem in the anthracite mines;

(i) Investigating the economic feasibility of railroad electrification;

(j) Development of greater use of electricity for home heating;

(k) Study of the effect on industrial location of low cost power;

(l) Investigating the market possibilities of reducing the first cost of commercial and industrial heating installations by selling the units below cost and regaining the loss in small increments in the sale of the coal;

(m) Exploring alternative means of transporting coal energy: water, pipeline, high voltage transmission, and conveyor belts.

(9) The legislature establish a resource development board, the membership of such board to include representatives of management, labor and the sciences which deal with mineral research.

(10) The legislature use its good offices to encourage the Federal Government to expand its program of basic and applied coal research and to devote an equitable share of its resources to research that will benefit Pennsylvania anthracite and bituminous coal.

(11) Labor and management continue to work together, as they have in the past decade, toward forging a modern, highly mechanized industry.

(12) Coal companies as individual companies and through their associations, engage in a progressive expansion of their research activities, particularly in the areas of developmental, market, and applied research.

(13) Mining equipment manufacturers work in close harmony with the coal companies to assure the development of improved mining and processing equipment.

(14) The railroads intensify their efforts in connection with the development of transport methods, such as the integral trains, that will lower the cost of transporting coal.

(15) Industries which are both producers and consumers of coal—steel and electric utilities—continue to work toward the improved utilization of coal.

Part 2

# COAL IN PENNSYLVANIA: RECENT DEVELOPMENTS AND PROSPECTS*

At the turn of the century the keys to industrial success and prosperity were coal and iron. At that time, Pennsylvania was the ranking mineral producer among the states and close to 90 percent of the Nation's energy output was generated by coal. In Pennsylvania iron ore from her own mines and from Minnesota and Michigan moved toward the metallurgical coal, the water, the skilled labor, the transportation, and the markets of the Commonwealth. Manufacturing plants clustered around the steel centers, industry and utilities demanded coal for heat and power, and anthracite provided the premium home heating fuel for the populous Eastern Seaboard. Steam locomotives shuttled back and forth to keep raw materials and finished goods moving.

In the years during and immediately after World War I, this activity reached a peak in Pennsylvania. In a typical year during this period, 194,981 western Pennsylvania miners produced 178,550,741 tons of bituminous coal. In the east, 175,030 miners were digging 99,611,811 tons of anthracite. Coal was "King" and Pennsylvania was the keystone of the growing industrial might of the United States. In contrast, in 1961 there were only 27,357 men producing 62,652,095 tons of bituminous coal, and 15,792 men mining 17,446,439 tons of anthracite. The economic impact of the loss of over 325,000 jobs and the income from almost 200 million tons of coal is felt throughout all of Pennsylvania. Though felt more acutely in Pennsylvania than in some other industrial communities whose economies were less dependent upon coal, iron and steel, the relative importance of coal as an energy

* The panel wishes to acknowledge the assistance of J. J. Schanz, Professor of Mineral Economics, The Pennsylvania State University, in connection with the preparation of this outline.

source decreased throughout the Nation. Only two decades ago anthracite and bituminous coal provided 56 percent of the Nation's energy. Today, coal accounts for but 22 percent of the energy generated. The catastrophic fall in Pennsylvania coal production has been accompanied by the decline in the relative importance of steel which is attributable to an increasing dependence upon such materials as aluminum, concrete, glass, and plastics. The technological changes which have struck so severely at coal have not yet run their course. Changes in iron and steel-making practices threaten the use of metallurgical coal as we presently know it. New ways of generating electricity by means of fuel cells and magnetohydrodynamic generators are being explored. In the future, both nuclear power and solar energy may be utilized in the generation of electricity—coal's principal growth market.

The reduction in Pennsylvania coal output is not due to the depletion of the State's coal reserves, but to drastic shifts in demand. As a matter of fact, it is estimated that there are over seven billion tons of anthracite and over 28 billion tons of bituminous coal still left untouched by past mining. At the present level of production and with current percentage recoveries, this represents a supply that can be expected to last several hundred years.

Currently, coal recovery percentages in many Pennsylvania fields cluster around 50 percent. This is but another way of saying that with contemporary techniques, 50 percent of the coal in actively mined seams is irreparably lost. It is essential to develop more efficient recovery methods if Pennsylvania's most valuable mineral asset is not to be wasted.

Productivity in the coal industry as a whole has doubled in the recent past. The doubling of the Nation's coal mining productivity in ten years (1951–1961) is without parallel in the history of the mineral industries. However, increases in productivity have not improved Pennsylvania's relative position. Currently, Pennsylvania lags behind in productivity when compared with its neighbor and effective competitor, West Virginia. For example, the five largest mining companies in central Pennsylvania operated in 1959 in seams averaging 42.8 inches. During the same year, the five largest companies in northern West Virginia operated in seams averaging 68.8 inches. Under these circumstances, it is not surprising that though the average tons produced per man-day in Pennsylvania's fields were but 11.30, average tons per man-

day produced in West Virginia's fields were 18.57. Again, in Pennsylvania fields, estimated labor costs per ton averaged $2.87; in West Virginia fields they averaged but $1.85. These cost differentials obtained in 1959 in spite of the fact that between 1953 and 1960, average tons produced per man-day in all Pennsylvania mines increased from 6.82 to 11.9 (see Reference Table 1, page 15).

A cost differential of approximately $1.00 per ton is quite significant in an industry which measures profit margins and competitive advantages in terms of a few cents per ton.

All shifts in demand take place via the price mechanisms. Aluminum, concrete, glass and plastics have become accepted substitutes for steel because of price differentials. The price of steel, in turn, depends in part upon the cost or price of coal.

The cost of transportation is a significant determinant of the competitive position of any fuel. The cheapest means of transporting a ton of fuel a mile is by water, pipelines are second, rail shipments are third, and truck transportation is the most expensive. Coal, which as a matter of general practice cannot as yet be economically shipped by pipeline, is at considerable disadvantage when competing with petroleum and natural gas which are shipped almost entirely by pipeline or water. Approximately 70 percent of bituminous coal moves by rail, 20 percent by truck and 10 percent by water. Fifty-five percent of anthracite moves by rail and 45 percent moves by truck. At present, over 40 percent of the delivered cost of an average ton of bituminous coal shipped by rail is accounted for by transportation charges. Transportation costs severely limit the distance coal can be economically shipped. Generally speaking, coal cannot be shipped more than 300 miles via rail. Cost of recovery aside, Pennsylvania-produced coal is at a competitive disadvantage by virtue of a railroad freight rate pattern which was established many years ago for the purpose of encouraging the development of virgin coal seams in areas distant from the industrial markets of the northeast. Initially, this pattern of freight rates was of little concern to Pennsylvania. Today, however, the pattern prevents Pennsylvania coal companies from taking advantage of their central location to compensate for the fact that coal mining costs in Pennsylvania are higher than mining costs in some other states. Coal fields with lower production costs and favorable freight rates, although more

distant than Pennsylvania's coal fields, have gained a large share of the Great Lakes and Tidewater trade. In some cases, the freight rates available to low production cost areas are actually lower than the rates charged Pennsylvania producers for shorter hauls to identical destinations.

Recently, efforts have been made to alleviate this situation. Trainload rates now in the process of establishment will greatly reduce the cost of delivering Pennsylvania coal to some important consuming centers.

Again, some of the pricing methods available to gas and oil cannot be utilized by the coal industry. Coal must compete with natural gas offered in the market on a so-called "interruptible" basis at a price which represents only the cost of handling it. Gas, or for that matter, oil, is sold at bargain prices on "interruptible" bases to keep pipelines operating at full capacity, a technique which reduces unit costs. In addition, oil producers largely because of their constant and massive research effort have developed a variety of products from one basic raw material which gives them both operational and market advantages which as of today coal does not enjoy.

In spite of historic setbacks, coal has a promising future both as a raw material and an energy source. The extent to which Pennsylvania will profitably participate in coal's expanding prospects depends upon the development and acceptance of an enlightened coal policy for the Commonwealth.

The prospects of coal as a raw material are illustrated by the increased utilization of carbon as a filtering agent, an electrical conductor, and a chemical additive. Furthermore, the demand for organic chemicals appears to be expanding rapidly.

The habit of regarding our coal seams as a vast reservoir of stored-up energy has led some of us to overlook the fact that coal is one of the most heterogenous and complex mixtures of substances found in the crust of the earth. Our coal seams are a treasure house of raw materials which can be transformed into an impressive array of valuable products ranging from simple activated carbons to complex plastics and synthetic liquid fuels. The key to the treasure house is ours if we broaden and deepen our deficient knowledge of the composition of coal. Specifically, research is required that will identify and describe the substances which comprise coal.

Consumers throughout the world constantly search for fuels and energy sources which require but minimal storage at points of consumption, minimal investment and maintenance cost for combustion equipment, and provide for "continuous flow." At the present stage of technological development, anthracite and bituminous coal in their original state do not meet these specifications. At the present, these specifications are met only by electricity. This fact is tremendously important to coal because the coal industry so far has been able to preserve its traditional share of the electrical utility market. There is reason to believe that in the not too distant future virtually all energy will be purchased in the form of electricity. When that day comes, coal may be restored to its historic position as an energy source.

For all practical purposes, the demand for energy appears to be unlimited. Projections of energy consumption to 1975 suggest the probability of a 50 percent increase in the Nation's energy requirements bringing total energy consumption to approximately 75 thousand trillion B.T.U.'s per year. Coal, currently the most widely used fuel for the production of electricity, has an excellent opportunity to participate in the spectacular growth in energy consumption.

To participate in this growth, Pennsylvania coal must be mined at a cost that will make possible effective competition with coal from other states and with other fuels. Given sustained effort, Pennsylvania coal can be offered at competitive prices. Even today the spread between the price of coal and competitive fuels is relatively small in some important markets. For example, in the New England market the cost of a million B.T.U.'s generated by oil ranges from 35 to 40 cents; the cost of a million B.T.U.'s generated by coal ranges from 36 to 40 cents. (See Reference Table 2, page 16).

However, once coal becomes competitive in the Nation's markets, industrial activity within the Commonwealth is likely to expand at rates that will have most beneficial effects upon employment levels. Low cost energy is the magnet that attracts and holds industry.

In the past, Pennsylvania coal has lost some of its markets to coal mines in low cost virgin seams located in other states. Pennsylvania, because of its early entry into the extractive industries, has mined approximately 25 percent of its original reserves of its bituminous coal and 33 percent of its anthracite. In the past, Pennsylvania coal has lost other markets to competitive fuels: oil and gas. On balance, the

loss of our coal markets is attributable to one basic factor: our failure to devote time, energy and resources to the sustained systematic study of coal, its properties, and its use potentials.

A comparison of the research efforts in coal, oil, electricity, and gas, is instructive. The Committee on Interior and Insular Affairs of the United States Senate reports:

> "A total of $17 million to $20 million is spent annually on research and development in coal. Almost $10 million of this is Federal money, and one company alone accounts for $2 million of the balance.
>
> "The petroleum industry spends about $300 million annually on research, of which $24 million is federally financed and part of which is on petrochemicals. The Federal contribution presumably is employed in part on projects of military importance.
>
> "Shale oil research to date has amounted to $15 million by industry (two-thirds of it by one company) and $25 million by Government.
>
> "Electric and gas utilities spend relatively little on research, but manufacturers spend $100 million to $125 million annually (exclusive of expenditures on nuclear energy) on research in the generation and transmission of electric energy.
>
> "Government expenditures in the area of fuels and energy, including nuclear energy, total about $500 million a year out of total annual government research expenditures of about $10 billion."

The disparity between the total national research effort in coal and its competitor fuels is staggering. For a variety of reasons, such as the small size of coal companies, depressed prices, small profit margins, and lack of foresight, research by individual coal companies has always been of limited scope. Funds devoted to coal research represent less than one percent of the gross income received from coal sales.

Today, all of Pennsylvania, including the coal industry, is faced with the problem of doing in a short period of time the research that should have been undertaken over several decades. There is reason to believe that the difficulties confronting us today could have been avoided if an adequate research effort had been made in the past.

To be sure, the Commonwealth of Pennsylvania has recognized the need for coal research for many years. In 1939 the Commonwealth initiated a program designed to stimulate research under the joint auspices of the State government and private industry. However, the funds which were made available were restricted to coal utilization research. No appropriations were made available to study the important problems associated with mining, preparation, transportation and marketing. In 1955 the Coal Research Board was established by action of the General Assembly. The board was given an appropriation for research and authorized to contract for research that would create new uses and new markets for Pennsylvania coal. Considering the magnitude of the problem, the research effort financed by allocations of the Coal Research Board though not unproductive was inadequate to meet the challenge.

If research is to make a significant contribution toward the solution of the coal problem, it must be sufficiently well-supported to permit substantial research efforts designed to attack the problem from three distinct vantage points. In the first place, there must be basic research calculated to lead to a better understanding of the occurrence of particular types of coal in Pennsylvania's fields and to more precise knowledge of the petrographic, chemical and physical characteristics of Pennsylvania coal. Second, there must be applied research conducted with a view of finding the most economical methods to facilitate industry's applications of the findings of basic research. Third, there must be instituted a vigorous program of development research to demonstrate the commercial practicability of new processes and the entry into new markets.

In the past there has been a general tendency to seek immediate solutions through development research with the hope of finding new markets and new uses for coal. Development research must of necessity remain sterile if it cannot feed on the findings of basic and applied research. Without basic and applied research, development work at best can refine known processes and improve known uses.

Applied research can develop new processes and new markets if provided with sufficient funds to schedule scientific inquiries for periods ranging from two to ten years. However, if applied research is to make significant contributions toward the economical rehabilitation of the

coal industry, it must be provided with basic knowledge with respect to composition and characteristics of coal. We must have the courage to invest heavily in basic research in the immediate future if we are not to find ourselves in one or two decades confronted with the same problems which face us today.

Though research is essential if coal is to be restored to its historic prominence, it is equally important that the findings of research be interpreted to the industry. Incidences can be cited in which validated findings of coal research have lain fallow for more than two decades prior to their industrial exploitation. It is unrealistic to expect individual coal companies to support the staff of specialists required to interpret the complex products of modern research. If the historic lapse of time between scientific discovery and industrial application is to be shortened, it is essential that the Commonwealth establish a resource development board. The membership of such a board should include representatives of management, labor and the sciences which deal with mineral research. It should be part of the assignment of such a board to develop a comprehensive program of research and action designed to advance the economic position of coal through the encouragement of industries within the Commonwealth which will utilize coal as an energy source and as a raw material.

Part 3

# REFERENCE TABLES

## Reference Table 1

# PRODUCTIVITY, COAL SEAM THICKNESS, AND ESTIMATED LABOR COST: CENTRAL PENNSYLVANIA AND NORTHERN WEST VIRGINIA*

| | *Total Tons* | *Average Tons Per Man-Day* | *Average Seam Thickness (Inches)* | *Estimated Labor Cost Per Ton* |
|---|---|---|---|---|
| (1) | (2) | (3) | (4) | (5) |
| Central Pennsylvania | | | | |
| Company A | 3,050,866 | 9.57 | 47 | .... |
| Company B | 1,258,898 | 14.35 | 35 | .... |
| Company C | 1,160,625 | 11.07 | 43 | .... |
| Company D | 991,523 | 11.01 | 50 | .... |
| Company E | 650,720 | 10.50 | 39 | .... |
| All Companies | 7,112,632 | 11.30 | 42.8 | $2.87 |
| Northern West Virginia | | | | |
| Company A | 5,659,043 | 22.17 | 82 | .... |
| Company B | 5,351,275 | 19.44 | 94 | .... |
| Company C | 2,540,283 | 19.39 | 91 | .... |
| Company D | 1,689,080 | 16.40 | 102 | .... |
| Company E | 1,111,213 | 15.44 | 75 | .... |
| All Companies | 16,350,894 | 18.57 | 68.8 | $1.85 |

* Data calculated from Pennsylvania Department of Mines and Mineral Industries reports and from West Virginia Department of Mines and Northern West Virginia Coal Association reports.

REFERENCE TABLE 2

## COMPARATIVE COST OF COMPETITIVE FUELS FOR STEAM ELECTRIC PLANTS LOCATED IN SELECTED AREAS

| *Area* | *Fuel* | *Cost per Million B.T.U.* |
|---|---|---|
| (1) | (2) | (3) |
| New England | Coal | $0.36 — $0.40 |
| | Oil | $0.35 — $0.40 |
| Eastern Seaboard | Coal | $0.34 — $0.37 |
| | Oil | $0.32 — $0.37 |
| | Gas | $0.32 — $0.40 |
| District of Columbia | Coal | $0.24 — $0.35* |
| Western Pennsylvania | Coal | $0.17 — $0.23* |

* Electric utility consumption of gas and oil is negligible.

SOURCE: Calculated from National Coal Association and Federal Power Commission reports.

## Reference Table 3

# AVERAGE PRODUCTIVITY IN PENNSYLVANIA'S BITUMINOUS COAL FIELDS, 1953 AND 1960

| *County* | *Average Productivity T/MD* 1953* | *Average Productivity T/MD* 1960* | *Production Tons 1960* | *Percent Strip Coal 1960* |
|---|---|---|---|---|
| (1) | (2) | (3) | (4) | (5) |
| Allegheny | 6.82 | 11.9 | 5,218,357 | 11.1% |
| Armstrong | 10.01 | 11.6 | 2,850,370 | 54.5 |
| Beaver | 9.79 | 15.1 | 371,621 | 97.5 |
| Bedford | 4.52 | 5.6 | 197,011 | 36.9 |
| Blair | 7.34 | 6.4 | 75,430 | 90.5 |
| Bradford | 6.03 | 7.9 | 7,651 | 100.0 |
| Butler | 9.57 | 15.2 | 1,976,582 | 86.5 |
| Cambria | 5.16 | 8.1 | 6,701,785 | 7.7 |
| Cameron | 18.80 | 13.2 | 107,578 | 100.0 |
| Centre | 9.09 | 10.1 | 703,016 | 93.5 |
| Clarion | 11.09 | 12.8 | 2,622,224 | 97.8 |
| Clearfield | 8.33 | 11.0 | 6,289,354 | 81.5 |
| Clinton | 11.21 | 14.5 | 479,839 | 97.8 |
| Elk | 9.62 | 7.6 | 302,480 | 53.3 |
| Fayette | 5.60 | 7.6 | 2,245,909 | 15.8 |
| Fulton and Lycoming | 11.31 | 8.0 | 65,516 | 82.0 |
| Greene | 6.57 | 11.7 | 9,966,944 | 0.2 |
| Huntingdon | 7.66 | 4.9 | 58,600 | 68.2 |
| Indiana | 7.47 | 10.2 | 5,126,721 | 15.0 |
| Jefferson | 7.64 | 9.9 | 1,147,022 | 78.5 |
| Lawrence | 16.34 | 16.6 | 942,037 | 99.0 |
| McKean | 11.95 | 27.2 | 32,030 | 100.0 |
| Mercer | 8.94 | 15.0 | 692,342 | 97.0 |
| Somerset | 5.98 | 8.5 | 2,181,308 | 55.3 |
| Tioga | 5.82 | 10.8 | 242,375 | 90.4 |
| Venango | 13.97 | 24.7 | 676,517 | 99.9 |
| Washington | 6.51 | 11.1 | 10,913,281 | 9.4 |
| Westmoreland | 6.23 | 11.1 | 3,362,099 | 4.1 |
| TOTAL | 6.96 | 11.1 | 65,595,999 | |

* Tons per man-day.

SOURCE: Taken or calculated from U. S. Bureau of Mines and Pennsylvania Department of Mines and Mineral Industries reports.