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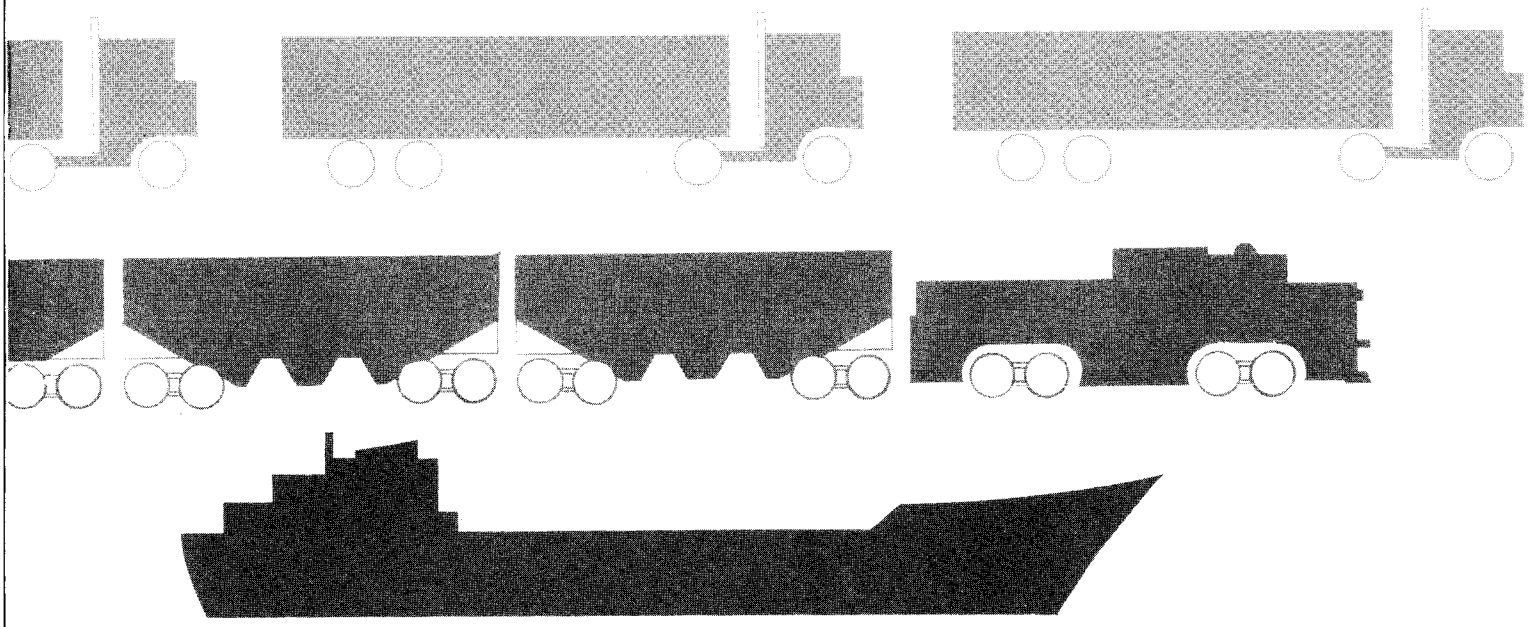

COAL PRODUCTION EXPANSION

A Selected Bilbiography

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July 1980

Technical Information Center
UNITED STATES DEPARTMENT of ENERGY

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A monthly abstract journal devoted to information on coal. *Coal Abstracts* is available to Department of Energy components and contractors from the Technical Information Center. Non-DOE organizations may obtain *Coal Abstracts* from IEA Coal Research, Technical Information Service, 14-15 Lower Grosvenor Place, London SW1W 0EX, England, for 64 pounds sterling per year.

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COAL PRODUCTION EXPANSION
A Selected Bibliography

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About this Bibliography

The expeditious and economic transport of coal from producing regions to consuming regions is essential to any policy designed to increase the use of coal as an energy source. Obtaining an optimal coal transportation system, including terminal facilities, is significant in providing U. S. coal to its users in the United States and abroad. Rail, barge, truck, slurry pipeline, and ship are the modes used to move coal from the producer to the user. Transportation costs represent a large percentage of the delivered price.

This bibliography includes 138 selected citations on coal export, transport, and production. The references are to reports from the Department of Energy and its contractors, reports from other government or private organizations, and journal articles, books, conference papers, and monographs from U. S. originators.

These citations and hundreds of additional citations on this subject are available for on-line searching and retrieval from the Technical Information Center's Energy Data Base using the DOE/RECON interactive system. Approximately 50,000 citations on coal and coal products are a part of this data base. Current additions to data base on this subject are announced monthly in *Fossil Energy Update*. DOE-sponsored work is also announced in *Energy Research Abstracts*.

The citations in this publication are arranged in broad subject categories as shown in the table of contents. Five indexes are provided: Corporate, Author, Subject, Contract Number, and Report Number. Included as an appendix are some tables and figures from Energy Information Administration reports covering coal production and disposition.

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•ABSTRACTS

The principal elements of abstract entries for a typical research and development report and a typical technical journal article are illustrated below.

Date of publication Report number Contract number
Author(s) Corporate Title Availability

8726 (DOE/R5/10126-1) **Combine wood/fuel technologies with a group-oriented timber stand improvement program: model for waste wood utilization and resource renewal. First quarterly report.** Dularney, S. (Long Island Oyster Farms, Inc., Northport, NY (USA)). 1979. Contract FG02-79R510126. 7p. Dep. NTIS, PC A02/MF A01.

Abstract: The duties of the County Forester in Michigan are outlined. Stress is placed on the management of wood lots and public assistance programs. Goals for legislation are discussed. Market data for firewood is presented and several news articles are included.

Author(s) Journal citation Date of publication Title

9768 **Gasification of solid waste fuels in a fixed bed gasifier.** Mudge, L.K.; Rohrmann, C.A. (Battelle Northwest, Richland, WA). *ACS Symp. Ser.*: **76**: 126-141 (1978).

Abstract: A gasification process is described where the waste is fed through a lock hopper into the top of a vertical, cylindrical retort through which it gravitates through zones of increasing temperature. The waste is dried and pyrolyzed to a char and the char is gasified and burned. The gas flow is countercurrent to that of the solids. An air steam blast at ~150° is fed into the retort through the grate into an ash zone that projects the grate and distributes the gas over the cross section. Tests were carried out in pilot plant facilities with 1- and 3-ft diameter reactors. The feed materials were municipal refuse, wood wastes (chips, shavings), agricultural residues (corn stalks, grass straw), tires, and simulated nuclear wastes.

•INDEXES

Five indexes are provided for approaching the contents of this bibliography. Each index is preceded by an introduction that details the organization of the index and the principles by which it was compiled. The reader is referred to these introductions for information not found in the index examples that follow.

•Corporate Index

Technical report literature is indexed using the name of the organization or institution responsible for the issuance of the report.

4204 (DSE-3077-T1) Investigation of woody biomass species for fuel production in warm climate, non-agricultural land irrigated by brackish or saline water. Final report, April 24, 1978–April 24, 1979. Garrett, D.E. (Garrett Energy Research and Engineering Co., Inc., Ojai, CA (USA)). 24 Apr 1979. Contract ET-78-C-01-3077. 209p. Dep. NTIS, PC A10/MF A01.

is indexed as:

Garrett Energy Research and Engineering Co., Inc., Ojai, CA (USA)
Investigation of woody biomass species for fuel production in warm climate, non-agricultural land irrigated by brackish or saline water. Final report, April 24, 1978–April 24, 1979, 4204 (DSE-3077-T1)

•Author Index

Each author's name is indexed in the form appearing on the document abstracted, with the exception that given names are reduced to initials:

Garnitz, R., Activities of the Department of Commerce, 4150 (SERI/TP-49-186, pp 27-29)
Garrett, D.E., Investigation of woody biomass species for fuel production in warm climate, non-agricultural land irrigated by brackish or saline water. Final report, April 24, 1978–April 24, 1979, 4204 (DSE-3077-T1)
Gaspar, P.P., *See* Mo, S.H., 4794
See Woods, R.P., 4793

•Subject Index

The subject index consisting of entries naming specific materials, objects, and processes is arranged alphabetically. Document titles, informative phrases, or both specific to these entries are arranged alphabetically under the entries.

WOOD/COST
Potential availability of wood as a feedstock for methanol production, 8724 (DOE/ET-0114/1)
WOOD/FERMENTATION
Retrospective search on the biochemical production of alcohol fuels, 8226 (NP-24137)
WOOD/MOISTURE
Fuel requirements of a 50-MW wood-fired electrical-generating facility in northern Vermont, 8444 (DSD-106)
WORKERS
See PERSONNEL

•Contract Number Index

DOE technical report literature is indexed using contract numbers. This index contains the contract number with corresponding abstract and report numbers.

ET-78-C-01-3050	**Westinghouse Electric Corp., Pittsburgh, PA (USA). Research and Development Center**	
	4755	FE-3050-T2
ET-78-C-01-3077	**Garrett Energy Research and Engineering Co., Inc., Ojai, CA (USA)**	
	4204	DSE-3077-T1
ET-78-C-04-5397	**Gilbert/Commonwealth, Reading, PA (USA)**	
	4213	DOE/ET/23057-1(Vol.2)

•Report Number Index

Technical report literature is also indexed using report numbers. This index includes information on where individual reports may be obtained. While not reports, patents and conference papers are indexed here as a matter of convenience.

DSE-		
3077-T1	4204	Dep. NTIS, PC A10/MF A01
4042-T6	4187	Dep. NTIS, PC A02/MF A01
EDAC-		
175-090.01	4528	*See* UCRL-15110
EDM-		
1107	4670	Federal Trade Commission, Bureau of Consumer Protection, Washington, DC

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Abstract

One hundred thirty-eight selected citations on coal export, transport, and production are presented. The references are to reports from the Department of Energy and its contractors and other publications from U. S. originators. Five indexes are provided: Corporate, Author, Subject, Contract Number, and Report Number. Included as an appendix are tables and figures from DOE's Energy Information Administration reports covering coal production and disposition.

ABSTRACTS

Production

1 (DOE/EIA--0118(77)) BITUMINOUS COAL AND LIGNITE PRODUCTION AND MINE OPERATIONS-1977. ENERGY DATA REPORT. Boykins, C. (Department of Energy, Washington, DC (USA). Energy Information Administration). 21 Dec 1979. 86p. Dep. NTIS, PC A05/MF A01.

This report is primarily a compilation of tables and illustrations that detail various aspects of bituminous coal and lignite production and mine operations in the United States in 1977. It covers such basic sectors as production tonnages, mining methods, employment, productivity, coal preparation, values, shipments, and coalbeds mined during the year. The data are from mines that produced 1000 tons or more. All production tonnages represent marketable coal and as such exclude refuse. In 1977 bituminous coal and lignite production reached an all time high of 691.3 million tons, surpassing by almost 2 percent the previous record of 678.7 million tons in 1976. Production from underground mines totaled about 266.0 million tons, down 9.8 percent from 294.9 million tons the previous year. Surface-mined production rose 10.8 percent to 425.4 million tons from 383.8 million tons in 1976. Coal was produced in 25 States. The leading coal-producing States were Kentucky, West Virginia, Pennsylvania, Illinois, Ohio, Wyoming, and Virginia. Together, these States accounted for 74 percent of the total US coal production. The Appalachian Region continued to be the major coal producing region, accounting for 393.8 million tons or 57.0 percent of the total production. In December 1977, production declined sharply when the 1974 contract between the United Mine Workers of America (UMWA) and the Bituminous Coal Operators Association (BCOA) expired and about 160,000 active UMWA members went on strike. By the end of 1977, all BCOA mines and about 60 percent of all other coal mines were idle because of picketing or sympathy strikes.

2 (DOE/IR--0056) DETERMINANTS OF COAL MINE LABOR PRODUCTIVITY CHANGE. Baker, J.G.; Stevenson, W.L. (Oak Ridge Associated Universities, Inc., TN (USA)). Nov 1979. Contract EY-76-C-05-0033. 202p. Dep. NTIS, PC A10/MF A01.

Coal mine labor productivity (tons per miner-shift) has been falling yearly since 1970. The decline in labor productivity since 1970 has implications for the coal industry's labor demand, cost of production, and injuries and could hinder the ability of the industry to meet the coal output goals of the National Energy Plan. The purpose of this research study was to identify and measure the causes of labor productivity decline. Concise answers are given to three questions: Why is coal mine labor productivity important. What are the causes of labor productivity decline in deep and surface coal mines. What are the implications of these findings for future coal mine labor productivity. Coal mine labor productivity is important for three reasons: (1) it affects the cost of coal production, (2) it affects coal industry labor demand, and (3) it affects injuries and injury rates in coal mining. Labor productivity is the link between output levels and employment requirements. The period of declining productivity coincides with major changes in the coal industry's environment: (1) change from a largely unregulated industry to a highly regulated industry (the Coal Mine Health and Safety Act of 1969; implementation of many state surface mine reclamation laws, etc.) and (2) change from a declining, marginal profits industry to a growing, profitable industry (increasing coal prices and demand in the 1970s). A major conclusion of the study is that a portion of the high labor productivity of the 1960s was possible because some of the costs of coal mining - worker injuries, black lung disability, and environmental damage - were not being paid for by the coal industry and coal consumers. Once these costs were forced internally on the mine operators by legislation, productivity fell and the cost of production increased.

3 (DOE/TIC--10785) COAL SUPPLY POTENTIAL. TASK GROUP REPORT. (Bureau of Mines, Washington, DC (USA)). 14 Jan 1975. 47p. Dep. NTIS, PC A03/MF A01.

Numerous coal industry representatives at the Project Independence Public Hearings, at the Coal Supply Workshop that formed part of this Task Group, and in other forms have repeatedly expressed considerable confidence concerning the ability of the coal industry to provide adequate coal to meet projected demands in the 1980s provided the demands were reasonably stable and predictable. This confidence is based on the assumption that there will be sufficient time by 1980 to solve labor, equipment, and transportation problems. It is implied that the coal industry if given contracts now could produce the needed tonnage by 1980. Representatives of the utilities, however, were more skeptical of the coal industry's ability to meet the additional demand for coal that a coal conversion program would create. They report their experience is that not enough coal is being offered to satisfy current demand. They cited rapidly escalating prices of coal being sold in both the spot market and by long term contract as well as a deteriorating quality in coal being delivered from some sources. The analysis has developed predictions for coal prices based on

two methods. Prior to 1978 there will be a shortage of coal. For this reason the average contract price for high sulphur coal will be controlled by the oil parity method. This produces a predicted high sulphur, long-term delivered contract price for coal in 1978 of $25.76 per ton. After 1978, increased supplies of coal will restore market equilibrium and bring the long-term contract price down to the cost of production from the marginal shaft mine or $23.43 for high sulphur coal.

4 (FE-1216-T1) COAL MINING. (National Academy of Sciences, Washington, DC (USA)). 1978. Contract EX-76-C-01-1216. 100p. Dep. NTIS, PC A05/MF A01.

The panel on coal mining technology of the NRC committee on processing and utilization of fossil fuels was appointed to assess the distribution and quality of the nation's coal reserve, underground and surface mining techniques, processing techniques, manpower and transportation requirements, the environmental impact of coal mining, and other social and regulatory issues. The worsening energy shortage and the recent decline in coal mining productivity stimulated the panel to consider all factors influencing coal mining activities so that it could make recommendations for improving the environmental acceptability of coal mining and the health and safety of miners while also increasing productivity and improving the economics of coal mining. Nine conclusions are outlined and eight recommendations are presented.

5 (GJBX-7(80)) COMPARATIVE STUDY ON THE IMPACT OF COAL AND URANIUM MINING, PROCESSING, AND TRANSPORTATION IN THE WESTERN UNITED STATES. Sandquist, G.M. (Utah Univ., Salt Lake City (USA). Dept. of Mechanical and Industrial Engineering). Jun 1979. Contract EY-76-C-13-1664. 150p. Dep. NTIS, PC A07/MF A01.

A comparative study and quantitative assessment of the impacts, costs and benefits associated with the mining, processing and transportation of coal and uranium within the western states, specifically Arizona, California, Colorado, Montana, New Mexico, Oregon, Utah, Washington and Wyoming are presented. The western states possess 49% of the US reserve coal base, 67% of the total identified reserves and 82% of the hypothetical reserves. Western coal production has increased at an average annual rate of about 22% since 1970 and should become the major US coal supplier in the 1980's. The Colorado Plateau (in Arizona, Colorado, New Mexico and Utah) and the Wyoming Basin areas account for 72% of the $15/lb U_3O_8 resources, 76% of the $30/lb, and 75% of the $50/lb resources. It is apparent that the West will serve as the major supplier of domestic US coal and uranium fuels for at least the next several decades. Impacts considered are: environmental impacts, (land, water, air quality); health effects of coal and uranium mining, processing, and transportation; risks from transportation accidents; radiological impact of coal and uranium mining; social and economic impacts; and aesthetic impacts (land, air, noise, water, biota, and man-made objects). Economic benefits are discussed.

6 (ORAU--141) COAL MINE LABOR PRODUCTIVITY: THE PROBLEM, POLICY IMPLICATIONS, AND LITERATURE REVIEW. Baker, J.G. (Oak Ridge Associated Universities, Inc., TN (USA)). Apr 1978. Contract EY-76-C-05-0033. 36p. Dep. NTIS, PC A03/MF A01.

Coal mining productivity in the USA increased dramatically between 1950 and 1969; (from 6.79 to 19.90 tons per shift worker) between 1969 and 1976, productivity declined by one-third and the average cost per ton of coal increased fourfold. Hypothetical causes for the decrease in productivity are presented and further work on ascertaining the major causes and on the implications of these for energy policy are recommended. The uncertainties involved in forecasting productivity make it very difficult to estimate the manpower required to meet the President's 1985 production target. (LTN)

7 (ORAU-1155) COAL MINE LABOR PRODUCTIVITY: REVIEW OF ISSUES AND EVIDENCE. Baker, J.G.; Gaston, R.J. (Oak Ridge Associated Universities, Inc., TN (USA). Manpower Development Div.). May 1979. Contract EY-76-C-05-0033. 52p. Dep. NTIS, PC A04/MF A01.

Productivity in bituminous coal and lignite mining has declined substantially during the 1970s. This decline has implications on coal industry labor demand, production cost, and worker health and safety. This report reviews existing research that has attempted to explain the productivity decline. The research results reported here indicate that deep mine productivity has been reduced by the Coal Mine Health and Safety Act of 1969, work stoppages, and the 1974 National Bituminous Coal Wage Agreement. In addition, there is strong evidence that manpower shortages have affected productivity. Surface mine productivity has declined because of a reduction in average mine size and state reclamation laws. Future research directions are discussed.

8 (ORNL/TM-6752) COUNTY COAL PROJECTIONS 1975-2000 PREPARED FOR THE NATIONAL COAL UTILIZATION ASSESSMENT. Bjornstad, D.J.; Stuckwish, D.N. (Oak Ridge National Lab., TN (USA)). Jan 1980. Contract W-7405-ENG-26. 87p. Dep. NTIS, PC A05/MF A01.

This paper describes the computational algorithm used by ORNL to project county coal production and employment levels for the NCUA, and the data and assumptions used to operate this algorithm. This system offers a highly simplified nonbehavioral method to obtain projections for small regions of the United States. The method tends to be highly sensitive to input assumptions regarding coal production levels at the higher regional level, because these levels are used as control totals for small area distributions. Moreover, as production increases the method tends to draw all eligible counties into production rapidly. Nonetheless, this approach does provide a useful way to investigate the credibility of scenarios that contain rapid expansions of the nation's coal extraction sector. The approach emphasizes the relatively remote locations of many reserve beds, while at the same time indicating the degree to which remote beds in many states must be exploited if scenario totals are to be met. As an example of the system's outputs, two projection series have been compared: one based on control totals from the SEAS-AEAR system and one based on ORNL calculations. Poor reserve data quality argues in favor of the simple approach this system employs. (LTN)

9 USA COAL INDUSTRY: DEMAND-LIMITED. Bennett, O. Jr. World Coal; 5: No. 11, 46-48(Nov 1979).

During the past ten years, while giving lip service to the greater use of coal, contradictory actions by congress and the

executive leadership indicate their collective unwillingness to adopt a workable energy policy. As a result of this dismal performance, ...the United States coal industry has become demand-limited, while its principal customers are frustrated by the myriad regulations that prohibit, restrain, delay, and discourage their increased use of this abundant resource. The coal industry has been so harassed by this regulatory avalanche that productivity declines of up to 50% are common, and the industry is losing its ability to compete in terms of price in the world market. Many of these regulations are unduly restrictive, unreasonable, unnecessary and are not cost effective for the limited and often questionable benefits they offer. The US has no option in terms of its economic independence and national security and in terms of its citizenship in the world community other than to develop and use its huge reserves of coal. The nation and its leadership must learn to balance national objecties on a cost/benefit basis. As Secretary Schlesinger said, the greater use of coal is indispensable. If this nation can overcome the obstacles to greater coal use, then the prospects for our security and well-being are reasonably good. The time is right for a renewed national commitment to coal. The time is long overdue for this renewed commitment to coal.

10 WORLD COAL INDUSTRY REPORT AND DIRECTORY. VOLUME 1, 1979--1980 EDITION. San Francisco, CA; Miller Freeman Publications (1979). 328p. Miller Freeman Publications, Order Department, 500 Howard Street, San Francisco, CA 94105.
The coal industries of Australia, Canada, China, Germany, India, Poland, South Africa, USSR, United Kingdom and USA are described with respect to coal deposits, coal reserves, coal quality, mining conditions, active mines, production, new developments, infrastructures, utilization, and trade. Individual mines are listed with a brief description. There is a section devoted to world coal trade. Also included are a buyer's guide and an index of equipment manufacturers. (LTN)

11 EXPANDED COAL PRODUCTION ENVIRONMENTAL IMPLICATIONS AND POLICY CONSIDERATIONS. El-Ashry, M.T. (Environ Def Fund, Denver, Colo). Am. Chem. Soc., Div. Fuel Chem., Prepr.; 23: No. 2, 257-268(1978). (CONF-780305--).
From American Chemical Society conference; Anaheim, CA, USA (12 Mar 1978).
Coal is considered one of the most valuable natural resources in the United States. Coal production in 1976 amounted to 665 million tons, and at such rate of production it could last for 300 years or more. Coal mining and coal conversion have significant impacts on the environment of a region, some of them are irreversible and permanent. They include adverse impacts on: water quality and quantity, topography, soil erosion, surface subsidence, land use, landscape aesthetics, air pollution and associated health effects, as well as social and economic impacts. Some of these impacts are not presently regulated. The subject is discussed under following headings-- environmental impacts of surface coal mining; environmental impacts of underground coal mining (acid mine drainage, subsidence, solid waste, abandoned mine fires); environmental impacts on coal conversion; environmental impacts of coal transportation; policy considerations. 21 refs.

12 LABOR-MANAGEMENT RELATIONS IN THE COAL INDUSTRY. Brennan, J. pp 71-78 of Proceedings of a symposium on coal dilemma: how and where to use it. Denver; Cameron Engineers, Inc. (1976).
From Symposium on coal dilemma: how and where to use it; Colorado Springs, CO, USA (31 Jan 1977).
See CONF-770133--.
Health and safety in the USA coal mines must be improved with the industry, unions and government all working together to minimize accidents, improve training, etc. Improved productivity is necessary and union cooperation is a necessary factor. Employment stability without strikes will benefit both the industry and the union. Unions and management will always disagree over many subjects, but such disagreement has to be carried on within an overall environment of mutually acceptable goals. (LTN)

13 EVALUATION OF UNDERGROUND COAL HAULAGE SYSTEMS. Belton, A.E. (John T. Boyd Co). Min. Congr. J.; 61: No. 10, 52-56(Oct 1975).
Advanced technology in coal mining has resulted in greater mining rates, but there is still a gap between mining of the coal and underground transportation. Until recently, the area of transportation had lacked attention and necessary dedication from mining equipment manufacturers, mining engineers and mine managers. Most new haulage methods largely represented extensions of existing ideas rather than breakthroughs into new areas. Now the coal industry has committed itself to improve all forms of underground coal mine transportation.

Transport

14 (AD-A--070221) AN ANALYSIS OF THE ISSUES AFFECTING THE COAL SLURRY PIPELINE MOVEMENT. MASTER'S THESIS. Williams, F.A. (Naval Postgraduate School, Monterey, CA (USA)). Mar 1979. 112p. NTIS PC A06/MF A01.
This thesis contains an examination, analysis, and commentary upon the prospective use of slurry pipelines as a supplemental means of coal transportation in support of the announced United States goal to double coal production by 1985. It examines the rudiments of the slurry industry and traces its growth to the present. A thorough review of the technical, legal, and political aspects of the controversial issues influencing the construction and operations of long distance coal pipelines is presented along with a commentary on the cases for and against slurries. Finally, sets of both general and specific conclusions are offered regarding the potential use of the coal pipelines.

15 (CONF-791160--2) COAL/OIL MIXTURE PIPELINE: A VIABLE ALTERNATIVE COAL TRANSPORTATION SYSTEM. Harkness, J.B.L.; Petrovic, L.J. (Argonne National Lab., IL (USA); Resource Engineering, Inc., Burlington, MA (USA)). 1979. Contract W-31-109-ENG-38. 23p. Dep. NTIS, PC A02/MF A01.
From 2. international symposium on coal-oil mixture combustion; Danvers, MA, USA (27 Nov 1979).
Slurry pipeline systems have been promoted as minimizing the environmental and socio-economic impacts of rail transportation and as increasing competition in interstate coal transportation. However, the scarce water resources of the coal rich western states may limit the number and/or capacity of these systems. Furthermore, these systems are not without their own operating and environmental problems. In this paper, a coal transportation

system which utilizes coal/oil mixture technology is compared to the coal/water system and to another alternative, coal/methanol system. The primary considerations addressed are the system design considerations and trade-offs, the resource requirements (including capital) and the cost of delivered energy. Considerations such as the system environmental impacts, the status of the technologies, oil quality and supply, and the potential system flexibilities are discussed qualitatively. This qualitative comparison shows that the coal/oil slurry pipeline is an attractive economic, environmental, and technical alternative for transporting coal PROVIDED that oil is available in the region. Coal/water pipelines are a second choice based on economics and, furthermore, are limited by their demands on western water resources. The third choice is coal/oil slurry pipelines using oil generated onsite. The main attraction is the saving of about 1/2 the water requirements. However, the capital costs will be high. Coal/methanol slurry pipelines do not appear to have any economic or environmental advantages. Further secondary considerations must be addressed before a technically and economically viable coal/oil surry pipeline could be implemented.

16 (COO--2970-1) COAL TRANSPORTATION STUDY. FINAL REPORT. Hood, R.; White, T.G. (General Motors Corp., Warren, MI (USA). GM Transportation Systems Div.). Sep 1977. Contract EY-76-C-02-2970. 349p. Dep. NTIS, PC A15/MF A01.

The Coal Transportation Involved a literature search of all relevant documents written in 1970 or later. The purpose of this search was to identify factors which could serve as indicators of the energy/cost efficiency of coal transportation. The various modes of transportation considered were barge, mixed rail, pipeline, and unit train. Over 170 reports, articles, hearings, and other studies were gathered and reviewed. The majority of the documents dealt with coal transportation efficiency in a very general way disregarding specific route factors such as circuity, grade, return trip, etc. The information was evaluated and summarized in a computer file. A detailed review of the computer output identified a wide range of values for many of the mode, volume, and distance combinations. Examination of the bibliography revealed little first-hand information from coal transporters. It was concluded that: (1) The data base constituted by those reports written since 1970 and currently in the public domain does not contain sufficient specific data to allow meaningful comparisons of coal transportation modes. (2) BTU/Tn-mi and cents/Tn-mi were the only factors specifically identified. Other specific route factors were generally not defined. Specific route factors which are essential to any inter-modal comparisons include: Circuity, grades, climatic effects, return of empties, unique terminal requirements, water availability, limitations of usage of transportation elements, and environmental impacts. (3) The impact of the specific route factors on the energy and cost requirements is significant. This precludes the use of the present data bank for any inter-modal comparisons of coal transportation.

17 (COO--4935-2) TRANSPORTATION OF COAL BY HYDRAULIC CONTAINER PIPELINE (HCP): A FEASIBILITY STUDY. Liu, H.; Assadollahbaik, M.; Yang, J.C. (Missouri Univ., Columbia (USA). Dept. of Civil Engineering). May 1979. Contract EM-78-S-02-4935. 71p. Dep. NTIS, PC A04/MF A01.

The purpose of this sponsored research is to assess the feasibility and the potential value of HCP (Hydraulic Container Pipeline) as a new mode of freight transport. The tasks of the study involve (1) assessment of the energy conservation value of HCP as compared to other modes of freight transport such as truck, rail and slurry pipeline, (2) assessment of the market of HCP for coal transportation, (3) development of design concepts on HCP system for transporting coal, and (4) design and construction of a small HCP system for the demonstration of the concept of HCP transportation. To date, the first three of the four aforementioned tasks have been completed; task 4 has just begun. This report deals with tasks 2 and 3. Another report, entitled Energy Conservation Value of Hydraulic Container Pipeline (HCP), deals with task 1. It is shown in this report that a large market exists for HCP to transport coal. Not only is HCP the most environmentally and socially acceptable way to transport coal, it can also compete effectively with truck, train and even slurry pipeline on economic grounds.

18 (DOE/EIA-0184/25) EVALUATION OF EFFECTS OF ALTERNATIVE WESTERN FREIGHT RATES FOR COAL. ANALYSIS REPORT AR/IA/80-04. Chamberlain, I. (Department of Energy, Washington, DC (USA). Energy Information Administration). Jan 1980. 26p. Dep. NTIS, PC A03/MF A01.

This report presents an analysis of the impact of coal rail transportation costs upon coal production, distribution, and consumption based on runs of the Midterm Energy Market Model (MEMM) using rate structures defined by the Interstate Commerce Commission. Overall levels of coal production in the United States change significantly in response to changes in western freight rates for coal. In addition, significant regional impacts can be expected in the coal producing areas of Northern and Central Appalachia, the Midwest, and the Western Northern Great Plains. Any increase or decrease in western freight rates will have an opposite effect on coal movements crossing the Mississippi River. In general, coal shipments from western producing areas to eastern coal markets are more sensitive to freight rate changes than vice versa. The amount of energy consumed in the United States would be negligibly affected by a change in western freight rates. However, electric utilities would substitute between coal and oil. In general, any freight rate increase would cause the electric utility industry to replace sub-bituminous fired generating capacity with bituminous units. However, in the West and New York/New Jersey regions, oil would be substituted in place of coal by operating existing distillate and residual units more intensively. Electricity prices are only slightly affected by western coal freight rates for coal. A quadrupling in western rail rates would cause average electricity prices to increase 6 percent.

19 (DOE/TIC-10053(Vol.1)) COMPARATIVE COAL TRANSPORTATION COSTS: AN ECONOMIC AND ENGINEERING ANALYSIS OF TRUCK, BELT, RAIL, BARGE AND COAL SLURRY AND PNEUMATIC PIPELINES. VOLUME 1. SUMMARY AND CONCLUSIONS. FINAL REPORT. Rieber, M.; Soo, S.L. (Illinois Univ., Urbana (USA). Center for Advanced Computation). Aug 1977. 91p. Dep. NTIS, PC A05/MF A01.

This study, an extension of our previous work in the area of coal transportation, is the comparative costing of competing transport modes. A wide range of costs and aspects of costs are dealt with in terms of engineering -

economic analyses of the cost of the components which make up the facility and operating system descriptions of each coal transport mode. The project is divided into two main sections: (1) long distance coal transport; and (2) gathering and distribution systems. Within each section, economic and technological comparisons of the available modes are used as the basis for comparisons among the modes. Inter-modal compatibility is studied with respect to both mixed trunk line shipment and with respect to feeder to trunk line and trunk line to distribution systems. The engineering and technological data form the bases for the costing and economic analyses. The cost basis includes all necessary processing, loading and unloading facilities needed for transport by each mode. Emphasis is placed on cost optimality and the ability to increase capacity. Specific studies are made of unit trains, barge, and coal slurry pipelines. The advantages and limitations of each system are analyzed.

20 (DOE/TIC--10536) COAL RAIL TRANSPORTATION OUTLOOK. (Federal Energy Administration, Washington, DC (USA)). May 1976. 67p. Dep. NTIS, MF A01.

Portions of document are illegible.

The Federal Energy Administration's Office of Coal contacted 16 major railroads in the spring of 1976 to determine their ability to handle coal traffic projected for 1980-85. The study showed: All solvent railroads plan to acquire the equipment they will need to meet increased coal traffic; most railroads have already installed 130-lb. welded rails; the railroads will be capable of meeting only a normal demand growth projected by the National Energy Outlook. (Any sudden increase in coal rail traffic could result in backlogs and delays); the railroads, like the coal mines, seek a near-term, national policy solution to the environmental question: will high sulfur Eastern coals continue in widespread use; capital availability is not viewed by the railroads as a problem for either expansion of track or rolling stock; the railroads believe that slurry pipeline development would be a serious setback to railroad expansion and financing plans; and the ICC now permits only annual rate agreements (they are urged to permit long-term rate agreements to facilitate expansion of facilities). In short, the solvent railroads can handle future coal traffic without significant US Government help. The bankrupt railroads, now merged into Conrail, present other problems: by 1985, Conrail will need at least 10,000 new hopper cars; massive upgrading of existing track and rolling stock are needed; and although several billions of dollars have been made available to Conrail for these purposes, it is not year clear whether much, if any, of these funds will be used to upgrade coal hauling track or equipment. Close FEA attention to this problem is needed in the months ahead.

21 (FE--1811-21(Vol.1), pp 218-292) PYROPHORICITY, INDUSTRIAL SAFETY, AND OCCUPATIONAL HEALTH ASPECTS OF COAL AND COAL DUST. (A LITERATURE REVIEW). Geiger, R.; Krizan, L.; McLaughlin, T.; Peterson, T.; LeFever, J.B.; Hall, S.; Bossard, F.C. Sep 1976.

MHD power generation: research, development, and engineering. Quarterly report.

A literature review pertaining to spontaneous combustibility and explosibility of lump coals and coal dust, industrial safety problems and procedures when processing, storing and transporting coal products, and potential occupational health problems from worker exposure to coal dust is summarized. An obvious conclusion was drawn during the literature review. A dirth of applied information exists, pertinent to the pyrophoric and safety hazards involved in the processing, transportation, and storing of the fine coal dust product required as a fuel feed to magnetohydrodynamic reactors during electric power generation. The spontaneous combustibility and explosibility of coal dust are not entirely understood from a theoretical standpoint, nor are they completely protected against in any installation similar to that required by the MHD facility. Such a local prototype will possess many inherent problems, always posing the potential of a catastrophe. Considerable information exists from studies on the storage and transportation of run-of-mine, and crushed coal products. The United States Bureau of Mines appears to possess leadership in the research conducted in this area. However, the bulk of their effort has consisted of research with eastern high-rank coals, as compared to the western subbituminous coals that will be consumed in the MHD process. In summary, the Montana Energy Research Development Institute will have to significantly expand the expenditure of resources in the area of coal dust pyrophoricity in order to develop adequate criteria for safe engineering and operation of the Component Development and Integration Facility.

22 (FE/EES--78/6) COAL SLURRY PIPELINES: WATER LAWS, CUSTOMS, AND AVAILABILITY. Campbell, T.C. (Department of Energy, Morgantown, WV (USA). Process Evaluation Office). Jun 1978. 18p. Dep. NTIS, PC A02/ MF A01.

Two basic concerns associated with the nation's effort to meet its energy needs are the capacity of the transportation system to move increasingly large bituminous coal tonnages to electric power generating plants and the availability of water for a wide variety of expanding uses in the eleven Western States. Both concerns have been at the forefront in the efforts by the U.S. Congress to decide whether slurry pipelines should be granted the right of eminent domain, a right that seems to be necessary in order to have coal moving by pipeline from mines in several Northern Great Plains and Rocky Mountain States to powerplants hundreds of miles away. This report deals with laws and customs related to water in the Western and other States, with special focus on water for long-distance coal slurry pipelines. Although the amount of water required for this purpose is not great, relative to the entire water supplies and needs in the various regions of the country, any water used that is not returned to the State from which it originates reduces the quantity available for other necessary or important purposes. Laws and customs are reviewed in order to provide background analysis for the serious efforts to seek solutions to, or possible modifications of, laws and current and past practices. Alternative sources significant distances away can be evaluated more effectively if the evaluations are based upon thorough and extensive analysis of the vast range of water-related problems.

23 (METC/SP--78/7) FACTORS AFFECTING FUTURE EXPANSION OF THE COAL TRANSPORTATION NETWORK: LEGAL AND INSTITUTIONAL CONSTRAINTS ON ACCELERATED COAL FREIGHT. Stacy, D.M. (West Virginia Univ., Morgantown (USA). Coll. of Law;

West Virginia Governor's Office of Economic and Community Development, Charleston (USA)). Jul 1978. 93p. Dep. NTIS, PC A05/MF A01.
This Department of Energy publication considers those factors which will determine the ability of the railroads, water carriers, coal slurry ppelines, high voltage electrical transmission lines, and truck movements to meet increasing demands for coal hauling capacity. The aim of this publication is to identify the major legal and institutional constraints confronting the coal haulers such that their resolution will result in expedient and economic transportation of coal to market.

24 (NP--23120) TRANSPORTING THE NATION'S COAL: A PRELIMINARY ASSESSMENT. (Department of Transportation, Washington, DC (USA)). Jan 1978. 80p. U.S. Dept. of Transportation, Washington, DC.
For the next decade and beyond, moving the Nation's coal will present a stern challenge to our transportation system. Meeting this challenge will be crucial to the success of the National Energy Plan, which calls for a two-thirds increase in annual coal production by 1985. A Task Force of senior Department of Transportation officials has completed the first phase of its evaluation of the transportation system's ability to move the greatly increased coal volumes projected for the mid-1980's; potential near-term bottlenecks and dislocations and the possible solutions; and problems which might be encountered in the longer term and how they might be best approached at this time. As coal grows in importance as a source of energy, the ability of the transportation system to move it efficiently from the mine to the place of use will become increasingly critical to the quality of our national lifestyle and the vigor of the national economy. This report has defined the broad dimensions of this challenge and outlined in general terms what needs to be done immediately. Working out the detailed solutions to the many problems that will be encountered over the next decade is a task that will require the combined efforts of industry, labor, and state and local governments, as well as the Federal Government.

25 (PB--253929) COAL TRANSPORTATION PRACTICES AND EQUIPMENT REQUIREMENTS TO 1985. INFORMATION CIRCULAR. Larwood, G.M.; Benson, D.C. (Bureau of Mines, Pittsburgh, PA (USA). Eastern Field Operation Center). May 1976. 99p. (BM-IC--8706). NTIS $5.00.
The report discusses the amount of transportation equipment required to move 1.2 billion tons of coal in 1985. Data pertaining to the regional origin-destination patterns, methods of movement, equipment stocks, rate structures, and operational capacities are presented for the major modes of coal haulage. (GRA)

26 (PB--276165) A PRELIMINARY FEASIBILITY STUDY OF STEAM COAL SLURRY MARINE TRANSPORT SYSTEMS. FINAL TECHNICAL REPORT. Roseman, D.P.; Tomassoni, C. (Hydronautics, Inc., Laurel, MD (USA)). Apr 1977. Contract MA-6-38072. 150p. NTIS PC A07/MF A01.
The anticipated increase in the export of steam coal from the United States provides an opportunity for establishing advanced handling and transport systems to serve the new markets. This study investigated the feasibility of using a coal-water slurry system to move the commodities in question. A specific export opportunity, from the U.S. to a new Mediterranean power plant, was investigated in detail. The study found that the use of slurry technology was technically feasible and offered the advantage of rapid loading and discharge rates, the ability to operate at offshore terminals and the elimination of air pollution during loading and unloading operations. The major disadvantages were found to be the requirements for large quantities of fresh water and the inherent problems of dewatering for both the ship loading and the power plant receiving portions of the system. The use of converted ships for the slurry trade were also studied. Converting a 225,000 DWT VLCC and an 80,000 DWT OBO were both found to be feasible, and the freight rates were found to be competitive.

27 (PB--285936) ENVIRONMENTAL ASSESSMENT OF COAL TRANSPORTATION. FINAL REPORT FOR 1976. Szabo, M.F. (PEDCO-Environmental, Inc., Cincinnati, OH (USA)). May 1978. Contract EPA-68-02-1321. 165p. NTIS PC A08/MF A01.
Work described in this report deals with (1) primary and secondary environmental impacts resulting from transportation of coal by slurry pipeline, railroad, barge, truck, and conveyor; (2) coal preparation and associated activities, such as loading and unloading, and (3) energy efficiencies of the transport modes.

28 (PB--289937) WATER TRANSPORTATION REQUIREMENTS FOR COAL MOVEMENT IN 1985. FINAL REPORT AUGUST 1976--AUGUST 1977. Witten, J.M.; Desai, S.A. (Input Output Computer Services, Inc., Cambridge, MA (USA)). Dec 1978. Contract DOT-TSC-1282. 114p. NTIS PC A06/MF A01.
This study of transportation requirements for coal movements through 1985 is one of a series conducted for the U.S. Department of Transportation to identify and quantify future transportation requirements for energy materials. The primary objectives of the study were to develop a scenario for 1985 coal production and consumption and to project water coal traffic equipment and facilities requirements consistent with the scenario. A second objective was to identify the planning processes used by the water carriers to identify and prepare for future traffic. The third objective of the study was to identify potential constraints to and institutional issues impacting increases in water coal traffic and the ability of the water carriers to handle it profitably.

29 (PB--290150) RAIL TRANSPORTATION REQUIREMENTS FOR COAL MOVEMENT IN 1985. FINAL REPORT, AUGUST 1976-AUGUST 1977. Witten, J.M.; Desai, S.A. (Input Output Computer Services, Inc., Cambridge, MA (USA)). Dec 1978. Contract DOT-TSC-1282. 160p. NTIS PC A08/MF A01.
The primary objectives of the study were to develop a scenario for 1985 coal production and consumption, and to project rail coal traffic volumes and equipment and facilities requirements consistent with the scenario. A second objective was to identify the planning processes used by the railroads to identify and prepare for future traffic. The third objective of the study was to identify potential constraints to the institutional issues impacting increases in rail coal traffic and the ability of the railroads to handle it profitably.

30 (PB--294072) COAL SLURRY PIPELINES: PROGRESS AND PROBLEMS FOR NEW ONES. (Army Missile Research Development and Engineering

Lab., Redstone Arsenal, AL (USA). Army High Energy Laser Directorate). 20 Apr 1979. 34p. NTIS, PC A03/MF A01.

This report summarizes information on some of the key issues concerning coal slurry pipelines--pipelines that carry a mixture of coal and water--and whether pipeline companies need Federal eminent domain legislation to help acquire rights-of-way along proposed routes. It discusses the current status of seven proposed pipelines and points out that at least four may be built by the mid-1980's even without Federal eminent domain legislation. The report highlights some recent changes that have occurred since the Coal Pipeline Act of 1978, proposed in the 95th Congress, was defeated in July 1978.

31 (PB--295818) THE ENVIRONMENTAL AND POLLUTION ASPECTS OF COAL SLURRY PIPELINES. FINAL REPORT, JULY 1976-MARCH 1978. Faddick, R.R. (Colorado School of Mines, Golden (USA)). Mar 1979. 123p. NTIS, PC A06/MF A01.

With the anticipated increases in coal consumption in the next decade, greater demands will be made on existing transportation systems to move to market the abundant reserves of coal in the U.S. Conventional transportation modes such as rail and barge will have to expand their capabilities by overcoming whatever shortages may exist in manpower, capital, and hardware. Simultaneously, lesser known systems such as coal in water (slurry) pipelines will have to share the transportation load. With some half dozen coal slurry pipelines being considered for construction within the next five years pending eminent domain legislation, it will be a matter of time before these lines are built. A coal slurry pipeline system may impact the environment at three stages: design, construction, operation and maintenance; and in three areas: slurry preparation, slurry piping and slurry separation. This work has examined these environmental and pollution aspects of coal slurry pipelines. Such an effort will enhance the selection of better design, construction, and operation techniques to provide a balance of engineering, economics, and environmental considerations.

32 (PNL--2420) ENERGY MATERIAL TRANSPORT, NOW THROUGH 2000, SYSTEM CHARACTERISTICS AND POTENTIAL PROBLEMS. TASK 2 FINAL REPORT: COAL TRANSPORTATION. DeSteese, J.G.; Bamberger, J.A.; Franklin, A.L.; Hendrickson, P.L.; Lippek, H.E.; Loscutoff, W.V.; Wilson, C.L. (Battelle Pacific Northwest Labs., Richland, WA (USA)). Jun 1978. Contract EY-76-C-06-1830. 106p. Dep. NTIS, PC A06/MF A01.

This report contains a summary characterization of the existing domestic coal transportation system and an assessment of some potential problems which may impact coal transportation in the United States during the balance of the century. A primary purpose of this task is to provide information and perspective that contributes to the evaluation of research and development needs and priorities in future programs. Specific concerns are identified which warrant additional programmatic effort to fill apparent gaps in the coverage of other relevant programs. Recommendations are made for new programs to address these concerns according to their apparent importance under conditions known or anticipated in early 1978. These recommendations are intended to encourage new research initiatives by the coal transportation industry, the Department of Energy (DOE) and other cognizant agencies. Concerns were identified by the analysis of problem issues associated with currently-projected growth scenarios for domestic coal consumption. The assessment of potential problem effects on the adequacy of future coal transportation assumes domestic coal production levels of approximately one billion tons in 1985 and two billion tons by the year 2000. The relative priorities of potential problems were judged on the basis of their overall impact on the system and the immediacy of this potential impact.

33 (PNL--3183) COARSE COAL HYDROTRANSPORT DATA PREDICTIONS. Lombardo, N.J.; Eyler, L.L. (Battelle Pacific Northwest Labs., Richland, WA (USA)). Jan 1980. Contract EY-76-C-06-1830. 48p. Dep. NTIS, PC A03/MF A01.

This report describes an independent evaluation of the hydrodynamic data obtained with coarse coal in 3- and 6-in. recirculation loops. The measured data are compared with several recently published predictive methods to evaluate data quality and determine data trends. A limited parameterization of these models to investigate their sensitivity is also presented. In recirculating loop tests, velocity ranges of 2 through 15 ft/sec were used to pump solid concentrations of up to 45% by weight. Pressure drop data were obtained for particle-to-pipe diameter ranges to 0.25 under various flow conditions. The predictive methods used to analyze the hydrodynamic data obtained include mechanistic models and empirical correlations. For each method, predicted versus measured headloss gradients were plotted to evaluate the ability of each method to reproduce the parameter trends exhibited by the pressure drop data. Of the five methods selected for analyzing the data, three could be used to predict the head loss gradients with some certainty, including a sliding bed model that provided predicted results equal to a regression analysis of the original data. The original correlation of the data was found to be capable of reproducing 90% of the measured results to within +-30%. It was therefore concluded that the original correlation and the sliding bed model provided sufficient accuracy to be used as a means for estimating the headloss for coarse particle coal systems in 3- and 6-in. lines. The success of the predictive methods in reproducing the parameter trends indicate that the data obtained were reasonably accurate and reliable. It is is expected that mechanistic models can become a valuable design tool for predicting hydrotransport performance over ranges of parameters.

34 (PNL-SA--6967) IDENTIFICATION AND PRIORITIZATION OF CONCERNS IN COAL TRANSPORTATION NOW THROUGH 2000. DeSteese, J.G.; Franklin, A.L. (Battelle Pacific Northwest Labs., Richland, WA (USA)). 1978. Contract EY-76-C-06-1830. 16p. (CONF-7806123--1). Dep. NTIS, PC A02/MF A01.

From Symposium on critical issues in coal transportation systems; Washington, DC, USA (14 Jun 1978).

This review presents the results of analysis used to identify and prioritize perceived potential problems that may hinder the development of coal transportation in the United States during the balance of the century. One objective of this effort is to discriminate serious concerns affecting the overall adequacy of coal transportation systems from issues of lesser significance. The concerns with the highest priority are anticipated to impact coal transportation in the early 1980s. These concerns relate to public acceptance, logistic problems with frozen coal, the impact of slurry pipelines,

and sludge transportation. Problems with the potential of impact in the balance of the century include the effects of rate rgulations on railroad incentives to haul coal, the safety and environmental impact of advanced slurry systems and congestion on inland waterways. A second objective of the analysis is to recommend specific actions that may mitigate the consequences of potential problems. The recommendations discussed in this paper include the need for new research, developments and demonstrations, risk assessments and other evaluations to fill possible gaps in the coverage of current programs that address aspects of the above concerns. Reasons are discussed for considering some familiar issues to be of lower importance than the above concerns, including railroad capital requirements, equipment availability, abandonment policy and sabotage, eminent domain for slurry pipelines, competition for barges at harvest time and potential impacts of the Clean Air Act amendments.

35 (TID--28762) MOVING A NATIONAL RESOURCE. A COMPENDIUM ON INTERREGIONAL COAL TRANSPORTATION. (Department of Energy, Lakewood, CO (USA). Interregional Coal Transportation Task Force). Sep 1978. 118p. Dep. NTIS, PC A06/MF A01.

This compendium was prepared as a four-region (V, VI, VII, and VIII) input to the National Energy Transportation Study (NETS) by the Interregional Coal Transportation (ICT) Task Force. It addresses only the aspects of coal and the transportation issues related to its movement within and across the regions. The ICT Task Force was formed in 1977 and is now represented by the Chicago, Dallas, Kansas City, and Denver regional offices of the Department of Energy (DOE). Region III, Philadelphia, has contributed as the eastern states' voice for comparative purposes. The paper's purpose is to identify the key state and regional issues which will be of consequence to the NETS endeavor. This compendium is presented in an unedited form and does not reflect official DOE policy. Specifically, the recommendations made in the Executive Summary are potential considerations as seen from a regional perspective.

36 (UT/CES-ES--5) ENERGY AND ENVIRONMENTAL ANALYSIS OF A PROPOSED COAL RAIL HAUL RATE INCREASE. ENVIRONMENTAL STUDY NO. 5. Cooper, H.B.H. Jr.; Miksad, R.W.; Fruh, E.G. (Texas Univ., Austin (USA). Center for Energy Studies). Aug 1978. 61p. NTIS, PC A04/MF A01.

An analysis has been made of the potential environmental impacts of the request by the Burlington Northern Railroad for a proposed rate increase to haul coal from a mine in Wyoming to the J.T. Dealy coal-fired power plant of the San Antonio City Public Service Board. The proposed rate increase by the railroad would raise the cost of moving the coal from the present $11.94 per ton to $18.23 per ton; the effect would be to make the coal less competitive than fuel oil and to cause increased oil burning at the V.H. Braunig and O.W. Sommers plants. This proposed action would affect the distribution of the types and amounts of fuel supplies used with resultant environmental impacts on air pollutant emissions, air quality levels and water quality parameters.

37 UNIT COAL-TRAIN SYSTEM. Electr. World; 192: No. 8, 51-82(15 Oct 1979).

A typical modern unit coal train generally comprises about 100 cars, plus three to five locomotives, depending on grades and curves, with each car carrying some 100 tons of coal. This 10,000 ton train continually operates back and forth between the source of coal and the generating plant - in essence, one basic origin, one basic destination, and car equipment remaining as a unit and operated as a shuttle. Predetermined schedules for train loading, haulage volumes, mine departure, plant arrival, train unloading, turnaround, and mine return permit the railroads to optimize operating conditions, while providing required coal deliveries to the plants on time. This article contains much information about railroad equipment, control, financing, etc. Also, the relative costs, applicability of, and competivity of unit trains, trucks, barges, and slurry pipelines are considered. (LTN)

38 OUTLOOK IMPROVING FOR US COAL SLURRY LINES. Oil Gas J.; 77: No. 37, 91-95(10 Sep 1979).

This paper discusses the improved prospects for coal slurry pipeline legislation being passed in the US. Details are given of the lines planned and the principal problems still to be overcome.

39 COAL TRANSPORTATION OUTLOOK REMAINS AS A CONFUSING AS EVER. Electr. Light Power (Boston); 57: No. 9, 33(Sep 1979).

The railroads are a favorite scapegoat for those trying to understand the confusing outlook for coal transportation in the US. Coal consumption has not increased as rapidly as was anticipated, but the new support for synthetic fuels will strain transportation systems. Recent rail rate increases, granted by the Interstate Commerce Commission as a way to help the rail industry stay economically viable, have also given a competitive edge to foreign coal. Utilities have explored other ways to transport coal, but have concluded that they are presently captive to the rail industry. Slurry pipelines remain an attractive alternative, but legislation to grant eminent domain is needed. Barge transport on the inland waterway system is also expanding.

40 ALTERNATIVES ARE STUDIED FOR MOVING COAL BY PIPELINE. Snoek, P.E.; Gandhi, R.L.; Weston, M.D. (Bechtel Inc, San Francisco, Calif). Oil Gas J.; 77: No. 35, 95-100(27 Aug 1979).

Five alternatives for transporting coal by pipelines are studied here. Each has its merits. The pipeline length, water or other fluid cost, and whether or not water would have to be recycled bear heavily on the choice. This article outlining the economic criteria under which these alternative modes may prove favorable used the following criteria: Coal quality--Western subbituminous, 28% equilibrium moisture; Throughput--BTU equivalent of 15 and 30 million tons/yr of as-mined surface-dry coal; Profile--flat.

41 ALTERNATIVES ARE STUDIED FOR MOVING COAL BY PIPELINE. Snoek, P.E. and others. Oil Gas J.; 77: No. 35, 95-100(27 Aug 1979).

Conventional coal pipeline transport is compared with dense phase transport, transport in a fluid other than water, transport of coal dried to 14% moisture content, and transport with recycled water. Cost comparisons are based on western US subbituminous coal and throughputs of 15 and 30 Mtce/year. Conventional slurry transport is cheapest and dense phase transport is most expensive.

42 SLURRY LINE BETTERS UNIT TRAINS, TEXAS STUDY FINDS. Coal Week; 5: No. 29, 3-4(16 Jul 1979).

A brief news item reports that the Center for Energy Studies of the University of Texas finds that the Houston Natural Gas Corporation proposed coal slurry pipeline is a better method for bringing western coal to Texas than unit trains. Reasons given are that direct costs of a pipeline are substantially less than those of rail systems over a 30 year period, and that demand for coal in Texas will support both the pipeline and an increased tonnage moved by rail. Qualifying factors include the railroads' ability to make long-term contracts, and the availability of water for the slurry lines.

43 SLURRY PIPELINES LINE UP FOR THE LONG HAUL. Coal Age; 84: No. 7, 82-84,87,90,93(Jul 1979).

Progress in building coal slurry pipelines in the US has been hampered by the difficulties of obtaining eminent domain rights and water rights. The many potential pipeline routes are shown and a number of projects are examined more closely. The legislative position is beginning to look more favourable for pipeline construction.

44 PRELIMINARY EVALUATION OF METHACOAL AS AN ALTERNATIVE METHOD OF COAL TRANSPORT. Bilsky, I.L. and others. J. Air Pollut. Control Assoc.; 29: No. 5, 569-577(May 1979).

Methacoal fuel is a mechanically stabilised suspension of coal in methanol produced by adjusting the weight ratio of carbon-hydrocarbon particles to alcohol to about 67% solids. The authors establish that there is a growing need for alternative fuel supplies.

45 MCDUFFIE TERMINALS: A MODERN USA COAL EXPORT PORT. World Coal; 5: No. 3, 18-19(Mar 1979).

With the United States balance of trade deficit at record levels and oil imports increasing every year, the Port of Mobile is becoming increasingly vital for United States exports, particularly coal exports. In one year (October 1, 1976 to September 30, 1977) alone, 3,100,000 metric tons of coal with a value of $166,000,000 were exported through McDurrie Terminals located on McDuffie Island, about 3.2 kilometers south of the Alabama State Docks in Mobile. Completed in January 1975, McDuffie Terminals is one of the most modern coal exporting facilities in the country. Coal is received by barge or by rail and transferred either directly onto ocean-going ships or to a live-storage area for future shipment. Approximately 90 percent of the coal handled at McDuffie is produced within the state of Alabama with most of the remainder coming from Tennessee, Kentucky, and Illinois. About 60 percent is transshipped to Japan, but other major destinations include Brazil, Italy, the Federal Republic of Germany, the United Kingdom, Rumania, and Canada.

46 LEGAL, LEGISLATIVE, AND INSTITUTIONAL OBSTACLES TO THE DEVELOPMENT OF CONSISTENT NATIONAL ENERGY AND TRANSPORTATION POLICIES. Francese, A.J. (United States Railway Association, Washington, DC). Nat. Resour. Lawyer; 11: No. 3, 569-613(1979).

Links between energy and transportation policies to encourage domestic energy source development, energy conservation, and environmental protection will require some tradeoffs to develop a coherent national policy that works. In order to remove impediments to consistent policies, the author recommends: (1) rational application, using incentives, of environmental restraints in non-attainment regions until the best-available control technologies for burning coal are available; (2) rate regulations that will permit railroads to recover adequate rates of return for the transportation of coal and other commodities; (3) permission for railroads to compete for coal traffic on the same basis as other modes; (4) permission for coal-slurry pipelines to operate where rail service is not available and protection to railroads losing volume to slurry pipelines; (5) eliminate unnecessary regulation, after careful review, of cooperative and joint ventures; and (6) create an energy tax trust fund to alleviate coal hopper car shortages and other transportation-energy-related purposes. 80 footnotes.

47 PROPOSED SALE OF PERMANENT EASEMENT FOR COAL-LOADING BARGE TERMINAL ON MELTON HILL RESERVOIR TRACTS XMHR-79R AND XMHR-80R. FINAL ENVIRONMENTAL IMPACT STATEMENT. Knoxville, TN; Tennessee Valley Authority (1979). 328p. (NP--24339).

The action proposed in the draft environmental impact statement was the granting of a permanent industrial easement on Melton Hill Reservoir Tracts XMHR-79R and XMHR-80R. TVA does not propose to grant the easement (the no action alternative). The easement would have enabled the construction and operation of a rail-to-barge regional coal-loading facility. Environmental impacts associated with the construction and operation of the proposed facility would have included: (a) change in land use from pasture to industrial on the 64-acre site; (b) destruction of between three and four acres of riparian and shallow reservoir habitat; (c) increase in turbidity and siltation from construction and dredging operations; (d) increasing area background noise levels from facility operation; (e) adverse effects to recreation and residential areas because of noise and aesthetic impacts; and (f) impacts to floodplains and wetlands.

48 SLURRY PIPELINES ECONOMIC AND POLITICAL ISSUES: A REVIEW. Banks, W.F. (Engineering Management and Development, Inc., San Diego, CA). pp 19-26 of Fourth international technical conference on slurry transportation. Washington, DC; Slurry Transport Association (1979).

From 4. international technical conference on slurry transportation; Las Vegas, NV, USA (28 Mar 1979).

In the controversy surrounding the proposal to grant federal eminent domain to coal slurry pipelines, the fundamental issue is whether, on balance, such a grant is in the national interest. The principal subissues (peripheral issues) of economics, water supply and disposal, energy consumption and conservation, employment, safety, and environmental impact are analyzed. It is found that, as compared with unit trains, which are the only immediate alternative for movement of large quantities of Western coal, the pipelines are not against the national interest, except in the case of employment. It is concluded that, on balance, the pipelines are in the national interest and should be granted the power of federal eminent domain.

49 COAL FREIGHT RATES: PAST AND FUTURE. Clark, J.R. pp 27-30 of Fourth international

technical conference on slurry transportation. Washington, DC; Slurry Transport Association (1979).

From 4. international technical conference on slurry transportation; Las Vegas, NV, USA (28 Mar 1979).

The Interstate Commerce Commission has primary jurisdiction over railroad freight rates. Its decisions regarding coal freight rates are reviewed. The author does not regard these decisions with respect to identified legal cases as consistent, nor to be based on consistent principles. The problems lie mainly in the area of how much fixed cost should be applied to a captive material tansported and how much to other materials transported where there is more competition. (LTN)

50 COAL TRANSPORTATION COSTS/INFLATION. Aude, T.C. (Energy Transportation Systems Inc., San Francisco, CA); Thompson, T.L. pp 122-129 of Fourth international technical conference on slurry transportation. Washington, DC; Slurry Transport Association (1979).

From 4. international technical conference on slurry transportation; Las Vegas, NV, USA (28 Mar 1979).

In the course of five years of effort, Energy Transportation Systems Inc. (ETSI) has undertaken in-depth evaluations of coal transportation costs. These cost studies were not only for slurry pipeline tansportation, but also evaluated the cost of the competing transportation mode, railroad unit trains. One result of these evaluations was the finding, which has been reported by the OTA and others, that both slurry pipelines and railroads have a role to play in western coal tansportation. One of the primary objectives in doing this work was to arrive at a fundamental understanding of the make-up of both pipeline and rail transportation cost. Understanding of the capital components and operating cost elements of the transportation costs was fundamental to testing the sensitivity of these costs to inflation, productivity improvements, technical innovations and regulations. It has been a frustrating experience trying to unravel the railroad cost picture. This complex, multi-commodity transportation business, with a long history of close regulation, has many eccentricities which obfuscate an understanding of the basic cost components. However, after considerable effort, an understanding of these costs has been achieved. In contrast, the pipeline system is a separate commercial entity without other business activities to complicate cost allocation. Obviously, there are other considerations in addition to cost that must be evaluated in choosing a coal transportation mode. These include environmental and resources-utilization considerations. Also, many people are concerned about utilization of the western water resources. This discussion concentrates on developing and understanding the costs associated with pipeline and rail transportation of coal.

51 EVALUATION OF ALTERNATIVE METHODS OF TRANSPORTING COAL USING SLURRY PIPELINES. Snoek, P.E.; Gandhi, R.L.; Weston, M.D. (Bechtel Inc., San Francisco, CA). pp 158-164 of Fourth international technical conference on slurry transportation. Washington, DC; Slurry Transport Association (1979).

From 4. international technical conference on slurry transportation; Las Vegas, NV, USA (28 Mar 1979).

Five alternative coal slurry tansportation systems have been examined for each of two throughput levels. For the water-coal systems, the conventional method of slurry transportation has been shown to result in the lowest cost for the ranges of throughputs and distances considered, if available water costs of less than about $5,000 per acre-foot are assumed. If the cost of water supply increases, recycle lines for moderate length systems (500 miles), and upgraded coal pipeline systems for long distances (1,500 miles) may result in transportation savings. If the technical feasibility of coal-oil transportation is resolved by commercial/pilot testing, this alternative may prove to be economic for long-distance pipelines if an oil carrier for the coal is located close to the mine site. Should water supply be severely restricted, transport by oil could prove desirable as long as significant amounts of water are not needed to obtain the oil carrier.

52 ECONOMICS OF NON-WATER COAL SLURRY SYSTEMS. Banks, W.F. (Engineering Management and Development, Inc., San Diego, CA). pp 165-170 of Fourth international technical conference on slurry transportation. Washington, DC; Slurry Transport Association (1979).

From 4. international technical conference on slurry transportation; Las Vegas, NV, USA (28 Mar 1979).

Our conclusions to date are: (1) oil slurries are not attractive until: separation technology is further developed and coal conversion technology is developed. (2) A methanol plant cannot be justified solely to pipeline coal. (3) Methanol offers at least two strong attractions over conventional slurries: reduction/elimination of the water requirements and the coal-methanol product mix is shippable at lower tariffs than by conventional pipelines. (4) Methanol is the only candidate carrier liquid with technology at hand.

53 INTERNATIONAL STEAM COAL TRADE POTENTIAL APPLICATION FOR SLURRY PIPELINE TECHNOLOGY. Pitts, J.D. (Bechtel, Inc., San Francisco, CA); Thompson, T.L.; Aude, T.C. pp 171-182 of Fourth international technical conference on slurry transportation. Washington, DC; Slurry Transport Association (1979).

From 4. international technical conference on slurry transportation; Las Vegas, NV, USA (28 Mar 1979).

This paper briefly discusses the current world energy picture, emphasizing trends in the international steam coal trade, and describes the key role of transportation in delivered steam coal costs and the expected economic breakthroughs, from the application of slurry technology to overland and maritime transportation. Because of coal's abundance, its location relative to use centers, and its low cost per Btu basis compared with oil and gas, international steam coal trade will increase dramatically in the future. Transportation costs are a major element of delivered fuel costs in international trade. The application of slurry pipeline and marine handling technology can significantly reduce the transportation costs of conventional rail/bulk shipment systems currently in use for coal transportation. Slurry pipeline technology is a proven method of long-distance, high-volume transport. Marine shipment by special slurry vessels, though based on available technology, will require testing before commercial operation. Major test programs on slurry dewatering, handling, and marine transport are under way or are planned for 1979 and 1980. Since coal delivered by such systems is less sensitive to inflation than oil or gas, substantial long-term cost savings can be realized using coal.

54 COAL IN INDUSTRY - THE CURRENT SCENE. Byrne, L.S. Heat. Air Cond. J.; 48: No. 560, 32,34,37,38,40,42,46,48,50,52(Sep 1978).
This paper describes the characteristics of coal as prepared for use in industry, and discusses some of the equipment available for coal handling and combustion, including the MaCawber dense phase pneumatic system for coal and ash handling;an automatic monorail system; chain grate, coking and underfeed stokers.

55 COAL SLURRY PIPELINES GO AHEAD, DESPITE DEFEAT IN CONGRESS. Coal Age; 83: No. 9, 11(Sep 1978).
A news item reports that, although the House of Representatives rejected the coal slurry pipeline bill, the issue is by no means dead. Even without legislation, it seems that some pipelines will be built. ETSI, for example, plans to proceed with its Wyoming to Louisiana line and has already obtained a number of rights-of-way by individual court cases, as well as rights of eminent domain along other sections of the route.

56 NEW STUDY LOOKS AT SLURRY LINES. Coal News (Wash., D.C.); No. 4418, 3-4(5 May 1978).
A National Energy Transportation Study suggests that western US coal production and markets may be sufficient to support both railroads and several slurry pipelines, but in the East the railroads may already be too weak to survive competition from pipelines or to cope with increased coal production alone.

57 HOW WILL ALL THE COAL BE SHIPPED. Miskell, J.T. Energy (Stamford, Conn.); 3: No. 1, 6-8(1978).
Whether announced goals are reached or not, there is already a large scale swing by utilities toward the use of coal in future additions to electric generating capacity. How this added coal production is to be transported is raising a number of questions about the country's ability to reach the goals set. This article analyzes the capabilities of the proposed means of transporting coal: by railroads, by barges, by motor trucks and conveyor belts (short-haul, from mine to utility) and by slurry pipelines. Consideration is given to the problems of providing sufficient new equipment for all these systems. Based on present projections of the share of the load to be carried by each type of transport, it seems that the railroads face the greatest challenge, and that slurry pipelines, where practicable, offer considerable economic advantages.

58 COAL SLURRY PIPELINES: THE WATER ISSUES. Rogozen, M.B. Los Angeles, CA; Univ. of California (1978). 284p. University Microfilms Order No.78-20,287.
Thesis (Ph. D.).
Citizens in arid coal source areas question the wisdom of exporting water to states where water is more abundant, and have expressed fears that increased pumping of ground water for certain slurry pipeline projects would adversely affect the aquifers upon which many of them depend. To assess the impacts of water use upon coal source areas, four hypothetical slurry pipeline systems were examined. Because of intense local concern over its use as a water source for a proposed Wyoming-Arkansas pipeline, the Madison Formation in Wyoming and South Dakota was studied in detail. In all the coal origin areas studied, water demand projected for 1985-2000 exceeds the legally available supply. Thus, a coal slurry pipeline could use water only at the expense of existing or projected alternative uses, the most important of which would be agriculture, municipal supply, and energy development. Water quality issues were also examined. Recovered slurry water is suitable for re-use as power plant coolant, as is the case for the one operating slurry pipeline-electric power plant system. High sodium absorption ratios and dissolved solids could pose problems for agricultural re-use. Before recovered slurry water is discharged to a natural water body, a thorough study of the effluent composition and the receiving water biota should be made.

59 ESTIMATING RAILROAD LINE CAPACITY. Kehr, C.L.; Kloer, C.D.; Pal, A.N. (Burlington North Inc, St. Paul, Minn). pp 427-434 of Proceedings of summer computer simulation conference. Montvale, NJ; AFIPS Press (1978).
From Proceedings of summer computer simulation conference; Newport Beach, CA, USA (24 Jul 1978).
Burlington Northern is experiencing a rapid growth in coal traffic due to increasing demand for coal and Burlington Northern's access to major coal producing areas. To accommodate this traffic, Burlington Northern must increase the capacity of many of its line segments. An important part of planning orderly additions to capacity is an analysis of existing capabilities and future line capacity requirements. The Industrial Engineering Section of Burlington Northern provides such an analysis using several simulation models. ''Estimating Railroad Line Capacity'' discusses the determinants of line capacity and the use of simulation models in analyzing line capacity. Models for different purposes are defined and discussed. Results obtained from these models are summarized. Finally, the role of simulation in the Burlington Northern planning process is explained.

60 MULTIMODAL ANALYSIS OF THE WESTERN COAL TRANSPORTATION SYSTEM. Ebeling, K.; Li, K. (North Dakota State Univ., Fargo). pp 588-596 of Fifth annual UMR-DNR conference on energy. Morgan, J.D. (ed.). Rolla, MO; Univ. of Missouri (1978).
From 5. conference on energy; Rolla, MO, USA (Oct 1978).
Points raised in the coal slurry pipeline issue imply a need for an analysis of the multimodal alternatives within the context of the existing western transportation system. In reporting the initial results of the first study of its kind, this paper includes a brief description of the data base and computer routines used to construct a base case and ideal case senerios of the western coal transportation issues.

61 TRANSPORTING COAL IN CONTAINERS THROUGH PIPELINE: A FEASIBILITY STUDY. Liu, H. (Univ. Of Missouri, Columbia). pp 597-605 of Fifth annual UMR-DNR conference on energy. Morgan, J.D. (ed.). Rolla, MO; Univ. of Missouri (1978).
From 5. conference on energy; Rolla, MO, USA (Oct 1978).
A preliminary assessment of the feasibility of transporting coal in containers suspended in water moving through pipes - the concept of hydraulic capsule (container) pipelining (HCP) - is presented. The assessment includes technical (engineering), environmental, social and economic considerations. A tentative conclusion reached is that HCP transportation of coal is

technically feasible (although it needs further research and development works), socially and environmentally beneficial, and economically justifiable in a number of situations.

62 REVIEW OF THE ECONOMICS OF COAL-SLURRY PIPELINES. Souder, P.S. Jr.; Imperial, J.F.; Tobias, L. (General Research Corp., McLean, VA). pp 7-15 of Proceedings of the 3rd international technical conference on slurry transportation. Washington, DC; Slurry Transport Association (1978).
From 3. international technical conference on slurry transportation; Las Vegas, NV, USA (29 Mar 1978).
Based upon the results of this study, coal-slurry-pipeline transportation can be more economical than rail transportation for long-distance, large-volume coal movements. Additionally, where rail conditions are relatively poor, coal-slurry pipelines can economically compete with rail transportation on intermediate distance and volume coal movements. The single most significant problem associated with coal-slurry pipelines is the availability of large volumes of water for slurrying the coal. The water question can be expected to be raised for every pipeline system proposed and, additionally, can be expected to be a restraint on the implementation of slurry pipelines. The authors believe that the next area of research relating to coal-slurry pipelines should be focused on examining the technical and economic feasibility of slurrying coal with other fluidizing media such as methanol, Alaska crude oil, oil shale, etc. Some research activity has been conducted on using methanol as the slurrying medium; however, what is needed at this point is a comprehensive examination of the use of alternative fluids for slurrying coal. 3 references, 4 tables.

63 ENVIRONMENTAL IMPACTS OF COAL-SLURRY PIPELINES AND UNIT TRAINS. Rogozen, M.B.; Margler, L.W. (Science Applications, Inc., Los Angeles, CA). pp 16-31 of Proceedings of the 3rd international technical conference on slurry transportation. Washington, DC; Slurry Transport Association (1978).
From 3. international technical conference on slurry transportation; Las Vegas, NV, USA (29 Mar 1978).
Both new coal-slurry pipeline construction and operation and expanded unit train operation each result in a variety of environmental impacts. This study attempts to objectively identify any significant impact from either method of coal transport. Since environmental impacts occur neither in the abstract nor in the aggregate, four site-specific case studies were performed. The four hypothetical coal transportation corridors studied were between specific towns from Wyoming to Texas, Montana to Minnesota and Wisconsin, Utah to California, and Tennessee to Florida. One of the major issues to confront western coal is water availability and water rights. Air pollution from pipeline operation and coal dust from rail hopper cars was discussed along with noise impacts, land use, and sociological issues. Biological impacts upon wildlife and vegetation were determined to be minimal. Rail transportation was projected to be a much more hazardous occupational method to move coal than pipeline transport. 58 references, 4 figures, 6 tables.

64 MATCHING COAL SOURCES, PIPELINE TRANSPORTATION, AND UTILITY MARKETS. Hensel, R.P.; Hamilton, T.B.; Martinez, O. (Combustion Engineering, Inc., Windsor, CT). pp 39-48 of Proceedings of the 3rd international technical conference on slurry transportation. Washington, DC; Slurry Transport Association (1978).
From 3. international technical conference on slurry transportation; Las Vegas, NV, USA (29 Mar 1978).
Coal-slurry-pipeline transportation has been demonstrated in two commercial applications, and a number of systems are now in various stages of planning. All the coal-pipeline systems that have been built or are being planned have one common objective: to supply fuel for the utility market. In planning the construction of a new coal-fired steam generator, a utility should consider the coal supply for the life of the unit, about 40 years. This requires coordination with coal suppliers to ensure a supply of coal that is compatible with the steam generator. Unit capacity and performance may be adversely affected if the unit is fired with coal with significantly different properties from the design coal. With proper planning for the coal supply at the beginning, however, excellent operating performance can be anticipated. The authors relate the various physical properties, chemical properties, etc. for various types of US coal. 9 references, 6 figures, 4 tables.

65 COAL TRANSPORTATION: BELT CONVEYORS, COMBINED RAIL-BARGE, AND SLURRY PIPELINES. Campbell, T.C. (WVa Univ, Morgantown). Am. Soc. Mech. Eng., [Pap.]; No. 78-WA/MH-1, 1-9(1978).
The capacity of the nation's transport system to move increasingly large tonnages of coal from mines to markets is a major energy problem. Coal accounts for more ton-miles of freight on the railroads and the waterways than does any other commodity. This work deals with belt conveyors, rail-barge combinations, and slurry pipelines as innovative additions to transport systems. In the past, both production and consumption have taken place within the same geographic regions. As late as 1969, the average length of coal hauls was only 225 miles. With the opening of the western mines along with increased emphasis on having new power plants designed to use coal, the market is becoming national in scope. Average hauls are much greater, with some being as long as 1200 miles. Each of the modes is considered, including its level of energy efficiency, its advantages and constraints, and how it can contribute to the overall capacity to transport this vital source of energy.

66 UPDATE ON SLURRY TRANSPORTATION FROM FACE TO CLEANING PLANT. Dahl, H.D.; Petry, E.F. (Cont Oil Co). Min. Congr. J.; 63: No. 12, 14-16(Dec 1977).
Consolidation Coal Co., is now undertaking the installation of a full-scale hydraulic transportation system to carry coarse coal from the mine face to the preparation plant at its Loveridge mine near Fairmont, W. Va. The facility will include all elements of a fully integrated haulage system, including face haulage for both longwall and continuous miner sections, multiple slurry feeds, hydraulic hoisting and 2.4 miles of overland slurry transport.

67 WHAT ARE REASONABLE UNIT TRAIN COAL TARIFFS: AN ATTORNEY'S PERSPECTIVE. Clark, J.R. pp 195-200 of Coal production and transportation: third annual conference, 1977. San Francisco; PLM, Inc. (1977).
The history of freight rate regulation in

the case of captive traffic is discussed in the light of legislation from 1887 to 1976. The author urges that rates on unit train coal movements be fixed at a level which will both cover the variable costs of providing the service and make a fair contribution towards constant costs and a reasonable profit. (LTN)

68 COAL PRODUCTION AND TRANSPORTATION. Stanislaus, J.L. pp 223-229 of Coal production and transportation: third annual conference, 1977. San Francisco; PLM, Inc. (1977).
Establishing a unit train operation requires input from the shipper, receiver, and the railroad. The shipper must furnish his loading capability, including limitations, to determine the amount of time required for loading. The receiver should supply the unloading conditions as well as the annual volume to be moved. With this information our transportation department determines the transit time, and adds the time required for loading and unloading which provides the cycle time. The number of cars required and train size are then determined, based upon the cycle times and annual volume to be moved, bearing in mind that the optimum train is the maximum number of cars in each train that will remain active in a continuous cycle (MOPAC maximum is 110 cars). The operating parameters are furnished to the cost department to develop the cost of operation. The parameters and costs are then forwarded to the pricing department for determining the freight rate to be published. Coal unit train rates are unique in that each movement is based upon the cost factors that apply to that specific movement. There are no relationships between movements. Each unit train system is developed and priced on its own circumstances. In order to insure feasibility in a unit train operation, our transportation department utilizes train performance simulators to measure accurately such things as locomotive and fuel requirements, draw bar stress, train speeds, running time schedules, and maximum train size, so that a real-time efficient operation is worked out and made ready for implementation. The one requirement necessary to justify a unit train operation is that annual volume must be sufficient to keep the equipment in a continuous cycle; otherwise, the economics of this method of transporting coal are lost.

69 COMPARATIVE ASSESSMENT OF WATER USE AND ENVIRONMENTAL IMPLICATIONS OF COAL SLURRY PIPELINES. Palmer, R.N. Washington, DC; Geological Survey (1977). 29p.
An analysis of water use and environmental effects of coal slurry pipeline transport is presented. Simulations of a hypothetical 1000 mile line transporting 12.5 million t/year indicate that pipeline costs and energy requirements are sensitive to the coal/water ratio. For realistic water prices, the optimal ratio will be near 50/50 by weight and about one fifth the amount required for on-site electrical generation. The environmental impacts of the different transport options are so different that a common basis for comparison does not exist.

70 COAL HANDLING AND STORAGE SYSTEMS. Smardo, P. (McNally Pittsburg Manufacturing Corp., Pittsbugh, KS). pp 1.137-1.152 of Energy technology handbook. Considine, D.M. (ed.). New York; McGraw-Hill, Inc. (1977).
Equipment and facilities for coal handling are described. Information is included on facilities for unit trains, barge loading systems, handling systems for coal users, and coal storage. (JRD)

71 RAILROAD TRANSPORTATION OF COAL. Sward, J.D. (Atchison, Topeka, and Santa Fe Railway Co., Chicago). pp 1.153-1.169 of Energy technology handbook. Considine, D.M. (ed.). New York; McGraw-Hill, Inc. (1977).
Types of rail service for coal transportation are described including single carload, multiple carloads, trainload volume service, and unit trains. Railroad cars for coal service are also described including open-top hopper cars, gondola cars, and rapid-discharge cars. Information is included on loading systems, unloading systems, terminals, and geographical aspects of coal transportation. (JRD)

72 BARGE MOVEMENT OF COAL. Price, W.L. (Dravo Corp., Pittsburgh). pp 1.170-1.177 of Energy technology handbook. Considine, D.M. (ed.). New York; McGraw-Hill, Inc. (1977).
Barge movement of coal on inland waterways and intercoastal waterways is discussed. Information is included on economic factors, Gulf intercoastal waterways, Great Lakes movement of coal, loading and unloading of barges on inland waterways, and barge design. (JRD)

73 COAL TRANSPORTATION BY SLURRY PIPELINE. Jacques, R.B.; Montfort, J.G. (Black Mesa Pipeline, Inc., Flagstaff, AZ). pp 1.178-1.187 of Energy technology handbook. Considine, D.M. (ed.). New York; McGraw-Hill, Inc. (1977).
Coal transport by slurry pipeline is discussed. An early Ohio installation is described along with the Black Mesa Arizona, system for coal slurry transport. The outlook for coal slurry pipelines is evaluated. (JRD)

74 NATIONAL ENERGY TRANSPORTATION. VOLUME I: CURRENT SYSTEMS AND MOVEMENTS. Washington, DC; Government Printing Office (1977). 627p.
Volume I presents the energy transportation factors (basic facts, historical background, current situation and systems, flexibility, and industry structure) which concern movement of natural gas, coal, petroleum and petroleum products, electricity, and nuclear fuel materials. Nineteen maps are appended that illustrate the movements of these energy sources. The map titles are: Natural Gas Movement by Pipeline; Coal Movements by Railroad; Coal Movements by Water; Total Coal Movement; Coal Resources and Distribution; Crude Oil Movement by Pipeline; Crude Oil Movement by Water; Petroleum Products Movements by Pipeline; Petroleum Products Movement by Water; Total Crude Oil Movement; Total Petroleum Products Movement; Total Petroleum Movement; Electric Power Transmission; Nuclear Fuel Materials Movement by Highways (Truckloads); Nuclear Fuel Material Movements by Highways (Btus); Pipeline Transportation Systems; Railroad, Highway, and Water Transportation Systems; and Total Interstate Energy Movement. (MCW)

75 ENVIRONMENTAL AND POLLUTION ASPECTS OF COAL SLURRY PIPELINES. Faddick, R.R.; Gusek, J.J. (Colorado School of Mines, Golden). pp 73-82 of Proceedings of the 2nd international technical conference on slurry transportation. Washington, DC; Slurry Transport Association (1977).
From 2. international technical conference

on slurry transportation; Las Vegas, NV, USA (2 Mar 1977).

With the anticipated increases in coal consumption the next decade, greater demands will be made on existing transportation systems to move to market the abundant reserves of coal in the US. Conventional transportation modes such as rail and barge will have to expand their capabilities by overcoming whatever shortages may exist in manpower, capital, and hardware. Simultaneously, lesser known systems such as coal in water (slurry) pipelines will have to share the transportation load. With some half-dozen coal slurry pipelines being considered for construction within the next five years, pending eminent domain legislation, it will be a matter of time before these lines are built. A coal slurry pipeline system may impact the environment at three stages: design, construction, operation and maintenance; and in three areas: slurry preparation, slurry pipeline, and slurry separation. This paper examines the environmental and pollution aspects of coal slurry pipelines to enable the selection of better design, construction, and operation techniques to provide a balance of engineering, economics, and environmental considerations.

76 NEGLIGIBLE ENVIRONMENTAL IMPACT OF COAL SLURRY PIPELINES. Buck, A.C. (Gulf Interstate Engineering Co., Houston, TX). pp 83-87 of Proceedings of the 2nd international technical conference on slurry transportation. Washington, DC; Slurry Transport Association (1977).

From 2. international technical conference on slurry transportation; Las Vegas, NV, USA (2 Mar 1977).

An obvious solution to the unit train impact problem is, of course, the notion of a coal slurry pipeline. The slurry line is dustless, noiseless (for all intents and purposes) and independent of the vagaries of weather, traffic and priorities of other shippers. A slurry line will demand a 30 to 50 foot wide right-of-way, cleared and maintained for line inspection. The slurry line also requires some valve sites, pump stations, and impondments, all less intrusive than a rail yard and switching terminal. Slurry lines when completed and in operation can be revegetated; they do not necessarily leave a cleared path across the landscape from origin to terminus. The line itself is out of sight and essentially out of the public eye; the land above the buried line can be dedicated to a variety of uses. The coal slurry line does require a pump station every fifty to one hundred miles. Pump stations demand power and commit adjacent tracts of land to ponding or water storage areas. Thus each pump station may be three or four acres in size and adjacent acreage of four to ten acres must be available for water storage. In almost every comparison, the environmental, socioeconomic, and aesthetic features of a coal slurry line even now outweigh the transient economic attractions of coal unit trains.

77 SLURRY PIPELINES: INNOVATION IN ENERGY TRANSPORTATION. Houston, TX; Houston Natural Gas Corp. (1976). 26p.

Texas has experienced a tremendous industrial expansion based on the use of natural gas in industrial boilers. Since gas reserves have decreased and gas has become more expensive, the Railroad Commission of Texas has ordered a phase out of the use of natural gas as an industrial boiler fuel beginning in 1980. This paper considers ways of transporting low-sulfur Western coal to Texas by mine mouth power generation and power transmission railways and slurry pipelines. The author favors slurry pipelines and provides data on more than 30 pipelines in use or planned for transporting various materials. The reliability, efficiency, safety, minimum environmental effects and economics of slurry pipelines are discussed. (LTN)

78 UNIT TRAIN COAL HAULAGE--CAN IT MEET THE CHALLENGES AHEAD. Graves, T.B. Jr. (Union Pac Railroad, Omaha, Nebr). Proc. Rocky Mt. Coal Min. Inst.; 37-40(1975).

Analysis of transportation problems is presented.

Marketing

79 (ANL/EES-TM--75) ASSESSMENT OF THE RELATIVE SOCIOECONOMIC EFFECTS OF INCREASED COAL DEVELOPMENT IN THE UNITED STATES. Stenehjem, E.J.; Santini, D.J. (Argonne National Lab., IL (USA)). Dec 1979. Contract W-31-109-ENG-38. 72p. Dep. NTIS, PC A04/MF A01.

This report contains a description of the Social and Economic Assessment Model, which is used to analyze the social and economic effects of energy development at the regional and county levels. Using the SEAM, the effects of coal mines and coal-fired utilities projected for over 340 US counties are examined. The study utilizes a clustering algorithm to determine the assimilative capacity of a county, that is, the county's ability to sustain the effects of an influx of population and thus an increased demand on its resources. The results of the clustering algorithm are used, together with county demographic data, as well as data on projected facility location, size, timing, and type, to estimate socioeconomic effects in terms of public costs that will be imposed on the affected populations. These results are aggregated to the regional level to give a rough estimate of the relative regional effects of coal development. The results indicate that 93% of the entire long-term, adverse impact from coal will be borne by states and counties of the Rocky Mountain area, whereas only 14% of the short-term impacts will be borne by this region. About 42% of the short-term costs will occur in the Southern region and 33% in the North Central region, but only 5% of the long-term costs are estimated for these two regions. Of the four major Census regions (Northeast, South, North Central, and West) only the Northeast is expected to be relatively free of community growth problems caused by coal development.

80 (CONF-770136--, pp 39p, Section 8, Paper 1) COAL OPTION, CONSTRAINTS TO GROWTH: ISSUES, IMPACTS, SOLUTIONS. Gambs, G.C. (Ford, Bacon, and Davis, Inc., New York). 1977.

From Coal production, use and financing conference; Washington, DC, USA (25 Jan 1977).

To summarize the coal situation, the U.S. has large and excellent reserves of coal which the mining industry is capable of mining from a technical standpoint. However, due to Government restrictions of various types, the coal industry is not being allowed to perform its role in helping to supply its share of the total energy mix which this country needs to survive as an industrial nation. Unless this is recognized in Washington and corrective action is taken to remove these obstacles and restrictions, there can be no hope that the U.S. coal industry can reach the production

goals which have been set.

81 (DOE/TIC-10493) ANALYSIS OF THE STRUCTURE OF THE STEAM COAL MARKET. INTERIM REPORT. (Mitre Corp., McLean, VA (USA)). 24 Feb 1975. 46p. Dep. NTIS, PC A03/MF A01.
This is a preliminary report. Its findings are largely incomplete. They are based on a small portion of the data and information base intended to be developed during an on-going study of the factors underlying coal prices. In the Fall of 1974, there was an apparent shortage of steam coal on the market. Spot prices were over $30 a ton on the average and, in some cases, reached $60 a ton. Contract prices averaged slightly above $13.00 a ton with highs over $35.00 a ton. By comparison, average April 1973 prices were about $10.50 for spot and $8.50 for contract. In mid-February, 1975, the tight market appeared to collapse. Spot prices, in a very weak market, had fallen to $15.00 and $20.00 a ton. There appears to be general agreement by both producers and users of steam coal for the apparent shortage of steam coal and the attendant disruption of the market during 1974. As an adjunct to the basic study, FEA asked that an attempt be made to evaluate the profit structure of the coal industry. It was found that available public data were insufficient to permit FEA to determine, among other things, whether or not coal industry profits were reasonable in 1974.

82 (EPRI-EA--496(Vol.3)) ECONOMIC ANALYSIS OF COAL SUPPLY: AN ASSESSMENT OF EXISTING STUDIES. FINAL REPORT. Gordon, R.L. (Pennsylvania State Univ., University Park (USA). Dept. of Mineral Economics). Jun 1979. 286p. Dep. NTIS, PC A13/MF A01.
This report is the fourth in a series on work relating to coal supply. Emphasis is on important extensions that have occurred to work treated in earlier volumes in this series. In particular, efforts by ICF, Inc., Charles River Associates, and Martin B. Zimmerman, the last both independently and in collaboration with Data Resources, Inc. are examined. Three coal supply models - those of National Economic Research Associates, Energy and Environmental Analysis, Inc., and the Argonne National Laboratories - and a world energy model developed by a group at the Virginia Polytechnique Institute and State University are reported for the first time. The report also covers a wide variety of other coal studies including several important surveys of the coal market in general, examination of competition in the coal industry, coal mine costing analyses, and assessments of regional impacts of coal industry development. The report also provides a discussion by the principal investigator of the principal problems in predicting coal industry developments.

83 (EPRI-EA--967) COAL IN TRANSITION: 1980--2000. FINAL REPORT. (Stanford Univ., CA (USA)). Feb 1979. 46p. Electric Power Research Inst., Palo Alto, CA.
Headquartered at Stanford University, the Energy Modeling Forum operates through a series of working groups of energy model developers and users to make comparative tests of a variety of energy models. The second group, under the direction of David Sternlight, chief economist at the Atlantic Richfield Company, examined ten models used to analyze the level and composition of coal production during the period 1980 to 2000. Results from the study show that all the models indicate a dramatic shift in the proportion of total U.S. coal production in the West under a variety of alternative assumptions about regional economics and environmental standards.

84 (EPRI-EA--1133) ANALYSIS OF BECHTEL'S REGIONAL ENERGY SYSTEM FOR PLANNING AND OPTIMIZATION OF NATIONAL SCENARIOS (RESPONS), AND ICF'S NATIONAL COAL MODEL (NCM). FINAL REPORT. Vogely, W.A. (Pennsylvania State Univ., University Park (USA). Dept. of Mineral Engineering). Jul 1979. 144p. Dep. NTIS, PC A07/MF A01.
This project, RP874, analyzed and compared two coal models - the I.C.F. Inc. National Coal Model (NCM) and the Bechtel Regional Energy System for Planning and Optimization of National Scenarios (RESPONS). The NCM is a single-period linear program and data base designed to forecast coal production, consumption, and prices in studies of coal-related public policy issues. RESPONS is a large system of interconnected models used to study energy supply and demand patterns. It includes a single-period linear program coal supply model and an associated data base. In this study, the RESPONS model was run on the Pennsylvania State University computer, and both the model and its output were reviewed. The NCM was not run, but its assumptions were analyzed and sample outputs from other sources were reviewed. The conclusion of the project was that the results produced by both models are useful but require careful interpretation. The project report recommends specific modeling methodology and data base improvements for both models to make the coal sector representation more realistic. Some of these improvements would require considerable additional effort.

85 WORLD COAL TRADE. Markon, G. World Coal; 5: No. 11, 28-32(Nov 1979).
World coal (anthracite and bituminous) trade in 1978 reached an estimated 199,083,000 metric tons, or slightly below the revised estimate of 201,472,000 tons traded in 1977. The total volume of coal moved in international trade in 1978 accounted for about 7.6% of the estimated production of bituminous and anthracite coals during the year. While the overall change in total world coal exports was minimal, changes occurred in the structure of the trade, some of them temporary, but did not materially affect the basic underlying strength of the international trade in coal. The constraints of higher prices, extensive and lengthy work stoppages in major supply sectors, and a generally modest demand for metallurgical coal on international markets were balanced by a steady growth in steam coal movements. Large metallurgical coal (and coke) stockpiles, an oversupply situation, exerted a downward pressure on coal prices, while increasing costs in coal mining and transportation (inland and ocean) displaced all but the most competitive coals in major markets. New availability of lower-priced, large-volume, steam coal supplies caused some redistribution of existing demand and absorbed new demand where the competitive edge and purchasers' planned diversification of supplies came into play. The background of rising costs of petroleum added a new perspective to planning the downstream coal demand and further strengthened the international steam coal outlook.

86 UNITED STATES COAL OUTLOOK. Emerson, J.D.; Calarco, V. Pet. Situat.; 3: No. 8, 1-3(Aug 1979).
Why have the government's coal policy initiatives failed to achieve their desired goals. The answer begins with the nature of

coal itself. Relative to its hydrocarbon cousins, oil and natural gas, the production of coal is more dangerous and has significantly greater environmental impact. It is more difficult and expensive to transport and store, and, most importantly, its burning characteristics make for more costly utilization. Added to these inherent disadvantages are the costs associated with environmental and safety legislation. These laws, while necessary in concept, have significantly increased the cost of mining, transporting, storing and using coal, thus offsetting much of the comparative cost advantage to coal from rising OPEC oil prices. In addition, coal was put at a further disadvantage by the fact that the federal government kept oil and natural gas prices below the market level. Other factors adversely affecting coal costs have been higher wages, royalties and severance taxes, as well as increased costs of equipment, supplies, and transportation. The net effect of these conditions is illustrated in a table of 1978 relative costs: coal, 100; low sulfur fuel oil, 81; and natural gas, 70. Shown is a comparison of the relative costs of the three fossil fuel alternatives available to a large industrial user. The annual costs of low sulfur fuel oil and natural gas have been indexed to the relative annual costs of the coal option; that is, coal equals 100. In addition, the percentage distribution of fuel costs and non-fuel costs to the total cost of each alternative is indicated.

87 WORLD ENERGY POLICIES: SOME MAJOR COUNTRIES ARE STILL FLOUNDERING. Coal Miner; 4: No. 2, 12, 14, 16, 18-19(Jun 1979).
Although North Sea oil and gas developments have eased the pressure on European energy users, it seems likely that European coal, though traded between member countries, will not be a major factor in other world markets. However, it is expected that world trade in coal will grow in the 1980s and beyond for reasons that include support of new industries in developing countries and replacement or support of oil imports.

88 STEAM COAL MARKET IN THE UNITED STATES: A QUANTITATIVE ANALYSIS OF SHORT-RUN SUPPLY AND DEMAND. Garling, W.S. Washington, DC; American Univ. (1979). 228p. University Microfilms Order No. 79-23,965.
Thesis (Ph. D.).
Since 1973, the United States has emphasized the development of domestic coal resources. This study analyzes the economic interrelationships in the United States steam coal market, to determine the feasibility of electric utility substitution of coal for other fuels in the short run. Questions of interest include to what extent utilities substitute coal for oil and natural gas in response to relative price changes, the degree to which coal characteristics such as sulfur and ash content affect steam coal demand, and the amount of surge capacity existing in the coal industry. The latter is an important factor in determining whether increases in demand result primarily in rising prices or in output changes. A short run quantitative model of the supply and demand for United States steam coal was developed and tested with monthly data from 1972 to 1976. Cross-section and time-series data were pooled, and analyses were performed by region. The regression results indicated that to a large extent fuel-purchasing practices were utility specific. Large between-firm variances were observed in the error components model, and the intercept dummy variables for firms in the covariance model were large and significant. On the supply side, price coefficients seldom were positive and significant.

89 WORLD COAL IMPORT AND EXPORT TRADE. Waring, D.R.T. (Inter-Cont Fuels Ltd). Coal Energy Q.; No. 18, 9-17(Aug 1978).
The author comments on the long-term coal needs and plans of both the established producers and the new entrants to the world coal scene. This survey of international coal production and trading, with its insight into the mounting requirements of bulk handling, is geared to the thesis that international cooperation and proper levels of investment will reduce, if not avoid altogether, the worst consequences of a worldwide energy shortage.

90 WESTERN COAL: PROBLEMS, PROGRESS, AND PROMISES. SUMMARY REPORT. Contract EW-78-A-02-4780. Golden, CO; Colorado School of Mines Research Institute (1978). 63p. (CONF-7809140--(Summ.)). $7.00.
From Western coal-problems, progress, and promises; Keystone, CO, USA (10 Sep 1978).
The Engineering Foundation conference on Western Coal: Problems, Progress, and Promises, focused attention on the significant issues affecting the development and usage of the region's vast reserves of coal. It appeared that the main issues centered around the lack of a National energy policy, the problems associated with the Federal coal leasing program, and the regulations promulgated by the Office of Surface Mining. The transportation of western coal was the subject of a lively session involving the railroad interests on one side and the interests of pipeline enthusiasts on the other. Technical issues were not neglected but were given coverage in the following areas: emerging mining technologies, preparation, utilization options, combustion research, and particulate/SOx emissions at the power station.

91 ANNUAL REPORT AND DIRECTORY OF MINES. Charleston, WV; Dept. of Mines (1978). 230p.
Data are compiled on the coal industry in West Virginia for 1978, including data on reserves, personnel, inspectors' salaries, revenues, production, injuries, accidents, and persons trained. Results of inspections are summarized. Examination sheets given to personnel are included. (MCW)

92 CRITICAL ALTERNATIVES IN THE USE OF COAL FOR AMERICA'S ENERGY FUTURE: A SUMMARY OF THE OTA REPORT. Maslan, F. pp 2p, Paper 6 of Outlook for coal: critical times for a critical fuel, New York, NY. New York; Energy Bureau, Inc. (27 Jun 1977).
The coal-supply and -consuming industries will expand tremendously between now and 2000. This expansion will be accompanied by drastic changes in technology, economics, regulations, and social-environmental outlook.

Planning and Policy

93 (ANL/EES-TM--47) METHODS OF ELIMINATING POTENTIAL SOCIOECONOMIC CONSTRAINTS ON NEAR-TERM COAL-ENERGY DEVELOPMENT. Santini, D.J.; Stenehjem, E.J.; Meguire, P. (Argonne National Lab., IL (USA)). Apr 1978. Contract W-31-109-ENG-38. 90p. Dep. NTIS, PC A05/MF A01.
Various possible socioeconomic constraints

on increased coal-energy development are considered: those on coal mining alone and those on the use of coal-fueled electricity or gasified coal for space heating. It is found that socioeconomic constraints on coal development should be more serious in sparsely populated areas, since such areas are subject to the greatest negative impact. Therefore, the elimination or mitigation of such constraints should be relatively more important in future coal development because of the concentration of such development in the sparsely-populated western US. Three methods of eliminating or reducing constraints are examined. First, at the national and regional level, appropriate selection of technologies is emphasized. In the southern US, coal-electric heating is desirable, whereas in the northern US coal gasification may now be desirable and certainly will be desirable in the future. Second, at the local level, the length of construction and siting of plants and mines may be varied. That is, under specified conditions, construction delay, mine-mouth siting, dispersion of coal mines, and siting in more populous counties may be useful techniques for reducing constraints. Third, when technology, timing and location have been decided on, some method of financing is needed to satisfy increased demands for public services. Several financing methods are examined, and a head tax or intergovernmental transfers from state or federal to local levels are rated as most desirable.

94 (ANL/IAPE/TM--78-2) COAL RELATED ISSUES IDENTIFIED BY STATE AND REGIONAL GROUPS IN THE MIDWEST. Hilton, M.L. (Argonne National Lab., IL (USA)). Nov 1977. Contract W-31-109-ENG-38. 110p. Dep. NTIS, PC A06/MF A01.

Coal-related problems of general concern include increased air pollution; effects of Prevention of Significant Deterioration and other Federal air quality regulations; potential water use conflicts; acid mine drainage and other problems related to reclamation of ''orphan'' lands; price and availability of alternative energy sources; transportation constraints; and lack of information on new coal technologies. Perhaps the most important problem stressed was the increase in air pollution that will result from increased coal use unless advanced emission-control technologies are used. This issue is of particular importance to states in the eastern half of the region. Here the increased use of local high-sulfur coals could aid the economy of coal-producing states such as Ohio and Illinois, but would also result in higher sulfur dioxide emissions. While there is a general concern over the impacts of increased air pollution, a related problem is that of meeting Federal standards designed to control pollution. Many states are having difficulty meeting National Ambient Air Quality Standards. Conflicts over water use related to coal development are expected to increase. While both coal-fired generating plants and the gasification plants require much water, demands for municipal and industrial supply, agriculture, and recreation are also increasing. Adequate disposal of solid and liquid wastes from emission-control systems is of concern to many Midwestern state governments. Transportation problems may also slow development of coal in the Midwest. Existing rail networks, cars and engines may not be adequate to haul the amount of low sulfur coal required in the next 20 years. Several other coal-related problems were mentioned at several meetings but were not as common as those discussed above.

95 (CONF-790672--3) CONSTRAINTS TO INCREASED COAL USE. Surles, T.; Hoover, L.J.; Goldberg, A.J. (Argonne National Lab., IL (USA)). 1979. Contract W-31-109-ENG-38. 4p. Dep. NTIS, PC A02/MF A01.

From International symposium on modeling, planning, and decision in energy systems; Montreux, Switzerland (19 Jun 1979).

The results of an assessment of potential constraints to increased coal production and use in the United States are presented. This broad-based assessment considered the effects of increased coal use on air quality, water quality and availability, local public services, public and occupational health, and national economics. Local and regional constraints found to be potentially significant include: increased public service costs in Rocky Mountain communities, violations of water quality standards, water availability in the Midwest and Rocky Mountains, nonattainment of air quality standards, solid waste disposal sites and costs for urban industry, health impacts of high ambient atmospheric sulfate levels, and uncertain effects of recently-enacted national environmental legislation. Strategies for overcoming such constraints are now being evaluated.

96 (CONF-791009--13) INCREASED COAL USE: THE NEED FOR STRATEGIES TO REDUCE LOCAL AND REGIONAL CONFLICTS. Surles, T.; Hoover, L.J.; Goldberg, A.J. (Argonne National Lab., IL (USA)). 1979. Contract W-31-109-ENG-38. 7p. Dep. NTIS, PC A02/MF A01.

From International conference on energy use management; Los Angeles, CA, USA (22 Oct 1979).

The analysis indicates that energy use management strategies need to be developed to ensure that local and regional conflicts emerging from the increased use of coal can be resolved with minimum adverse environmental, economic, and societal impacts. The major deterrent to reaching increased coal use goals, which are 160 GWe of new utility coal use and 4.5 Quads of new industrial coal use, appears to be the adulteration of air quality. Siting of utility and industrial sources in or near nonattainment areas or Prevention of Significant Deterioration (PSD) Class I or Class II areas may be constrained. 35% of new utility coal use may be inhibited in urban areas due to nonattainment provisions of the CAA. These problems are predicted to be most pronounced in the Northeast and Midwest. Increased coal use should not cause increased public health impacts. Although it is difficult to quantitate the anticipated health impacts with a high degree of certainty, relationships can be assumed between ambient atmospheric sulfate levels and adverse health effects. The major impact from coal use will arise in areas downwind from areas projected to be subject to increased energy production. These impacted areas are primarily located in the northeastern quadrant of the United States. In the western United States, long-range transport of sulfur dioxide or sulfates (SO_4) does not appear to constrain coal use on a regional level. Water quality and water availability constraints on site-specific bases are expected. Solid waste does not appear to moderate the achievement of increased coal use goals, particularly in the utility sector and, to a lesser extent, the coal extraction sector. It may, however, severely restrict increased coal use goals for industry, especially in the urban areas of the Midwest and Northeast, where a lack of suitable nearly solid waste disposal sites could result in high transportation costs.

97 (DOE/ET/2880--1) POSSIBLE FUTURE ENVIRONMENTAL ISSUES FOR FOSSIL FUEL TECHNOLOGIES. FINAL REPORT. Attaway, L.D. (Flow Resources Corp., San Rafael, CA (USA)). Jul 1979. Contract ET-78-C-01-2880. 245p. Dep. NTIS, PC A11/MF A01.

The work reported here was carried out for the Department of Energy's Office of Fossil Energy to identify and assess 15 to 20 major environmental issues likely to affect the implementation of fossil energy technologies between 1985 and 2000. The energy technologies specifically addressed are: oil recovery and processing; gas recovery and processing; coal liquefaction; coal gasification (surface); in situ coal gasification; direct coal combustion; advanced power systems; magnetohydrodynamics; surface oil shale retorting; and true and modified in situ oil shale retorting. Environmental analysis of these technologies included, in addition to the main processing steps, the complete fuel cycle from resource extraction to end use. The 16 environmental issues identified as those most likely for future regulatory actions and the main features of, and the possible regulatory actions associated with, each are as follows: disposal of solid waste from coal conversion and combustion technologies; water consumption by coal and oil shale conversion technologies; siting of coal conversion facilities; the carbon dioxide greenhouse effect; emission of polycyclic organic matter (POM); impacts of outer continental shelf (OCS) oil development; emission of trace elements; groundwater contamination; liquefied natural gas (LNG), safety and environmental factors; underground coal mining - health and safety; fugitive emissions from coal gasification and liquefaction - health and safety; boomtown effects; emission of fine particulates from coal, oil and oil shale technologies; emission of radioactivity from the mining and conversion of coal; emission of nitrogen oxides; and land disturbance from surface mining. (LTN)

98 (HCP/H70143--0) TECHNICAL ANALYSIS OF STEAM COAL PRICES IN SIX OECD COUNTRIES. (ICF, Inc., Washington, DC (USA)). Oct 1978. Contract EM-77-C-01-8766. 228p. Dep. NTIS, PC A11/MF A01.

This report analyzes of delivered-steam-coal prices in six countries (United Kingdom, West Germany, France, Italy, Canada, and Japan) in 1976 and provides DOE with a perspective and a framework for evaluating and interpreting reported steam-coal prices for these six countries. Strengths and weaknesses of the information supporting the prices were determined, and an assessment was made as to how these reported prices should be interpreted. The reported prices were compared to approximate estimates of the marginal mining costs in each of the six countries. The differences between the reported prices and the estimated marginal mining costs were studied to see what subsidies were implicit in the reported prices, and hence, whether the reported prices reflected the full costs of mining (i.e. recovery of all operating and capital costs). The regional coal production and consumption patterns in each of the countries were reviewed to examine regional differences in prices of delivered steam coal, and to identify potential markets for imported coal. Currently, DOE is using two documents for reported delivered-steam-coal prices (as well as for delivered prices of other energy sources) for the six countries (among other countries): (1) computer files maintained by the Office of Energy Data Development, DOE (these files exclude fuel prices to the utility sector); and (2) the Eighth Survey on Energy Price Statistics, compiled by the OECD Committee on Energy Policy.

99 (NP--22802) COAL AS AN ENERGY RESOURCE: CONFLICT AND CONSENSUS. ACADEMY FORUM, WASHINGTON, D.C., APRIL 4--6, 1977. (National Academy of Sciences, Washington, DC (USA)). 1977. 330p. National Academy of Sciences, Washington, DC.

A national energy policy is considered ruled out not only by shifting public perceptions but also by the pervasiveness of energy. Energy is embodied in all goods and services. Formulating a supply policy toward energy is highly difficult, although possibly feasible. For demand it is considered simply impossible. The real problem is postulated to be that the public has not yet figured out what it wants. Implicit in the future is an array of social decisions. Important decisions include the fertility rate, desires about per capita income, and the work-leisure decision. Individual and social decisions on such issues are complicated, interdependent, and certain to change over time. A second major issue has to do with other sources of fuel: oil, natural gas, uranium, and so on. The third of the major points concerns risk. (LTN)

100 (PB--234254) SURFACE MINING, LAND RECLAMATION, AND ACCEPTABLE STANDARDS. Greenbaum, M.E.; Harvey, C.E. (Kentucky Univ., Lexington (USA)). Jun 1974. 40p. (UKY-TR--83-74-IMMR-3). NTIS $3.95.

COAL;PRODUCTION;SURFACE MINING;LAND RECLAMATION;STANDARDS;LEGISLATION;TAXES; GOVERNMENT POLICIES;ECONOMICS;COAL MINING; REGULATIONS;LAND USE;COST

101 (SAN--1171-1/5) SLURRY PIPELINES: ECONOMIC AND POLITICAL ISSUES. A REVIEW. Banks, W.F. (Systems, Science and Software, La Jolla, CA (USA)). 30 Nov 1977. Contract EY-76-C-03-1171. 185p. (SSS-R--77-3023(Rev.1)). Dep. NTIS, PC A09/MF A01.

In the controversy surrounding the proposal to grant Federal eminent domain to coal-slurry pipelines, the fundamental issue is whether, on balance, such a grant is in the national interest. The principal subissues (peripheral issues) of economics, water supply and disposal, energy consumption and conservation, employment, safety, and environmental impact are analyzed. It is found that, as compared with unit trains, which are the only immediate alternative for movement of large quantities of Western coal, the pipelines are not against the national interest, except in the case of employment. It is concluded that, on balance, the pipelines are in the national interest and should be granted the power of Federal eminent domain.

102 (SAND--79-8655) RESEARCH EFFORTS IN EIGHT INDUSTRIAL COUNTRIES TO INCREASE THE USE OF COAL. Pohl, J.H.; Hardesty, D.R. (Sandia Labs., Livermore, CA (USA)). Jun 1979. Contract EY-76-C-04-0789. 38p. (CONF-791001--1). Dep. NTIS, PC A03/MF A01.

From United Nations symposium on world coal production; Katowice, Poland (Oct 1979).

During 1977 and 1978 we visited with, discussed coal research with, and reviewed the technical literature of coal research institutes in eight countries, Australia, Federal Republic of Germany, France, Netherlands, New Zealand, Polish People's Republic, United Kingdom, and the United States. We were able to visit utility companies, boiler manufacturers, private

research laboratories, government research laboratories, and universities in these countries. Coal is the only fuel other than nuclear power that can satisfy the short term energy needs of the world. Coal resources are adequate to fulfill these energy needs. In the future, as now, most of the coal used will be burned as pulverized coal in large industrial and utility boilers. However, two major problems must be addressed before use of coal can drastically increase. First pollutant emissions from coal-fired boilers must be controlled at levels acceptable to the populace and at costs acceptable to the utility operators. Second, improving the precision with which boilers are designed and the availability of the boiler during operation can improve the competitivity advantage of coal over other fuels. When these problems have been solved, world coal use should increase in proportion to coal resources. (LTN)

103 (TID--2945(Vol.2)) ASSESSMENT OF NATIONAL CONSEQUENCES OF INCREASED COAL UTILIZATION. EXECUTIVE SUMMARY. (Argonne National Lab., IL (USA); Brookhaven National Lab., Upton, NY (USA); California Univ., Berkeley (USA). Lawrence Berkeley Lab.; Los Alamos Scientific Lab., NM (USA); Oak Ridge National Lab., TN (USA); Battelle Pacific Northwest Labs., Richland, WA (USA)). Feb 1979. Contract W-31-109-ENG-38; EY-76-C-02-0016; W-7405-ENG-48; W-7405-ENG-36; W-7405-ENG-26; EY-76-C-06-1830. 322p. Dep. NTIS, PC A14/MF A01.

In addressing the set of National Energy Plan (NEP) scenario assumptions, ten technical areas were considered: Siting, Air Quality, Western Long-Range Transport of Sulfur, Eastern Long-Range Transport of Sulfur, Water Quality, Water Availability, Solid Waste, Local Socioeconomics, National Economics, and Health Effects. The major constraints to reaching NEP coal use goals, which are 160 GWe of new utility coal use and 4.5 Quads of new industrial coal use, appear to be those pertaining to air quality. They involve the siting of utility and industrial sources in or near nonattainment areas or Prevention of Significant Deterioration (PSD) Class I areas. Implementation of NEP initiatives should not cause increased public health impacts. The major impact on coal use will arise in areas upwind from population areas projected to be subject to high sulfate levels. Water quality and water availability constraints on site-specific bases are expected. Solid waste does not appear to be a constraint for achieving NEP coal use goals, particularly in the utility sector. It may, however, severely restrict NEP coal use goals for industry, especially in urban areas where a lack of suitable nearby solid waste disposal sites could result in high transportation costs. This factor could constrain up to 40% of new industrial coal use. Total occupational health impacts increase proportionately to coal production and utilization. The major occupational health effects in the mining sector will be disease and accidents. Given the generic nature of coal use and its increased usage, the conclusions found in this report should be reasonably accurate and serve as guidelines for assisting in policy decisions; regulations based on new or recent laws should be monitored and reviewed as they are promulgated. (LTN)

104 (TID--29425(Vol.1)) ASSESSMENT OF NATIONAL CONSEQUENCES OF INCREASED COAL UTILIZATION. EXECUTIVE SUMMARY. (Argonne National Lab., IL (USA); Brookhaven National Lab., Upton, NY (USA); California Univ., Berkeley (USA). Lawrence Berkeley Lab.; Los Alamos Scientific Lab., NM (USA); Oak Ridge National Lab., TN (USA); Battelle Pacific Northwest Labs., Richland, WA (USA)). Feb 1979. 89p. Dep. NTIS, PC A05/MF A01.

The major environmental constraints to reaching the coal-use goals of the NEP appear to be those pertaining to air quality. These constraints arise primarily because of the postulated siting of power plants and coal-burning industries in or near nonattainment areas (areas where air quality standards are currently violated) and Prevention of Significant Deterioration (PSD) Class I areas. Some additional air quality constraints may arise from siting coal-burning facilities in PSD Class II areas where allowable increments of total suspended particulates (TSP) and sulfur dioxide (SO_2) are almost exhausted. Further air quality constraints may arise from potential short-term violations of National Ambient Air Quality Standards (NAAQS) for TSP and SO_2. These constraints may affect 35% of the new utility coal use and up to 60% of the new industrial coal use projected for the NEP. Conversion of industrial boilers to coal may be inhibited in urban areas due to nonattainment provisions of the Clean Air Act Amendments (CAAA) which do not allow further deterioration in areas that already do not meet regulations, even if emissions are controlled by New Source Performance Standards (NSPS) that are more stringent than present State Implementation Plan (SIP) controls. Other constraints discussed are: Long range sulfur transport as dioxide and sulfates, health effects of air pollution, water quality and availability, solid waste disposal, socio-economic effects,economics (capital and labor investment required), occupational health and safety (accidents in mining and transporting coal), etc.

105 COAL CONVERSION TECHNOLOGIES: SOME HEALTH AND ENVIRONMENTAL EFFECTS. Morris, S.C.; Moskowitz, P.D.; Sevian, W.A.; Silberstein, S.; Hamilton, L.D. (Brookhaven National Lab., Upton, NY). Science; 206: 654-662(9 Nov 1979).

Several technologies to convert coal to liquid and gaseous fuels are being developed in the United States, some with support from the Department of Energy. Substitution of these technologies for those currently being used will produce different health and environmental hazards. In this article, selected health and environmental effects of four coal conversion and four existing technologies are compared. For each technology, the emission estimates for complete fuel cycles, including all steps in fuel use from extraction to the end use of space and water heating by electricity or direct combustion, were prepared by means of the Brookhaven Energy System Network Simulator model. Quantitative occupational health and safety estimates are presented for the extraction, transportation, distribution, processing, and conversion activities associated with each technology; also included are some public health damage estimates arising from fuel transportation and air pollution impacts. Qualitative estimates of health damage due to polycyclic organic matter and reduced sulfur are discussed. In general, energy inefficiencies, environmental residuals, and hence implied environmental effects and health damage increase in the order: (1) direct combustion of natural gas and oil; (2) direct combustion of synthetic gas and oil; (3) central-station electric power produced from synthetic gas; (4) central-station electric power produced from coal; and (5) central-station electric power produced by the

combustion of synthetic liquid fuels. The compliance and conflict of these technologies with the amendments of the Clean Air Act and other legislation are discussed.

106 COAL RATE CRUNCH. Loftus, M. (Slover and Loftus, Washington, DC). Public Power; 37: No. 6, 53-55(Nov 1979).
Lawsuits involving the pricing of coal-transportation services have been initiated by both coal receivers, who feel the rates are excessive, and the railroads, which feel too constraned. The receivers blame the railroads' monopoly of coal transport and their own need for long-term supply contracts for the high rates. The railroads claim the rates are a combination of expanded coal demand and the need for differential pricing to counterbalance their financial problems in other areas with coal-transport profits. The Interstate Commerce Commission's failure to set clear and consistent guidelines has complicated the problem, which is exemplified by a series of decisions in San Antonio, Texas. New rail deregulation proposals will be examined by congress. (DCK)

107 COAL: PROBLEMS AND PROSPECTS IN THE 1980S. Miernyk, W.H. (West Virginia Univ., Morgantown). J. Energy Dev.; 5: No. 1, 9-18(Aut 1979).
Although coal has had an up and down production history and a generally negative public image, it will be an important energy source long after the last oil and natural gas have been consumed. The 1950 mechanization agreement and the 1969 Federal Coal Mine Health and Safety Act have affected the industry's productivity and competitive position. The Project Independence Evaluation System (PIES) fuel forecasts for the 1980s projected a major boom for coal, but demand has since decreased as more oil became available. The countinued pressure of world oil prices should stimulate enough coal demand to reach President Carter's goal of 1.2 billion tons by 1985, however. Labor problems, capital shortages, and environmental legislation (especially regulations to control particulates and sulfur oxides) will slow coal production, but oil prices will eventually exert a greater pressure. 1 chart. (DCK)

108 RAIL RATE MAKING AT THE ICC: EXTRA COSTS FOR ELECTRIC UTILITIES. Shiriak, B.D. Public Util. Fortn.; 104: No. 7, 36-41(27 Sep 1979).
Our national energy policy, favoring the maximum possible use of coal as boiler fuel, and our national transportation policy, favoring the revitalization of the railroad industry, have collided at the Interstate Commerce Commission. The railroads have won. As a result, electric utilities will needlessly pay excessive rates, amounting to hundreds of millions of dollars, to transport coal by rail from the mine mouth to the power plant. An illustrative recent case is San Antonio, Texas, Acting by and through Its City Public Service Board v Burlington Northern, Inc. et al., a dispute over the unit-train tariff for shipments of 3 million tons per year of subbituminous coal from Wyoming to Texas. This article presents the background of the San Antonio case, summarizes how the commission reached its result, comments on and criticizes the commission's approach to several issues, and concludes with specific recommendations on how electric utilities can better prepare themselves for rate making at the ICC.

109 COAL SLURRY PIPELINES: ISSUES AND PROBLEMS. Richardson, L.K. (Richardson Associates, New York City, NY). Public Util. Fortn.; 104: No. 4, 22-30(16 Aug 1979).
The sharp increases in the cost of coal transportation to electric utility markets via rail are examined, with consideration given to the possible effect of railroad deregulation proposals on coal transport costs. Against this background, the author examines the economics of coal slurry pipelines, as alternatives to rail transportation and how to finance such pipelines without risking undue impairment of the credit standing of the pipelines' major customers, electric utilities.

110 COAL UPDATE: ISSUES IN INCREASING COAL USE THE SUBJECT OF PUBLIC HEARINGS FOR 60-DAY COAL STUDY. Energy Consum.; 1: No. 3, 2-37(Jun 1979).
Representatives of 41 public and private groups met with representatives of the DOE, the Department of the Interior, and the Environmental Protection Agency (EPA) to discuss how to increase the production, development, and use of coal. Eleven candidate topics prepared for the hearings are listed, followed by comments made by participants from state and local organizations, consumer and labor groups, industry and supplier groups, and environmental groups. Members of each group presented relevant issues and recommended policies which they considered appropriate.

111 PROSPECTS BRIGHTEN FOR COAL SLURRY PIPELINES. Chem. Eng. News (Wash., D.C.); 57: No. 21, 18-20(21 May 1979).
Coal slurry pipelines are experiencing a surge of activity. There are now eight pipeline projects in existence or being planned. Although it seems unlikely considering the institutional hurdles, all could be in operation by the mid-1980's. Technical problems have been overcome and the economic advantages of pipelines over rail transport for long distances are accepted. The major problems facing would-be pipeline operators involve legal battles over rights-of-way and obtaining enough water to operate the pipelines. Most of the coal to be transported by proposed pipelines will be mined in relatively arid regions where water is expensive and is a matter of some emotional concern. There are problems in satisfying these concerns and other environmentalists' objections. Because several studies (one from the Office of Technology assessment, and one from the General Accounting Office, particularly) have recently concluded with favorable assessments, there is optimism that Congress will alter the Federal laws pertaining to eminent domain, generally favorable to the railroads, pipeliners' major competitor.

112 COAL: THE PROGRAM, THE POLICIES, AND THE PARADOXES. Margolf, C.W. (W.R. Grace and Co, West Coal Oper). Min. Congr. J.; 65: No. 4, 63-65, 93(Apr 1979).
The country's goal for the coal industry is to achieve an annual production rate of 1.2 billion tons by 1985. About half of the time allowed to achieve it has passed. Yet, the coal industry is still producing about what it produced back in the 1940s. The coal program is reflected in national policies affecting coal. The author reviews these policies.

113 RENT AND REGULATION IN UNIT-TRAIN RATE DETERMINATION. Zimmerman, M.B.

(Massachusetts Inst. of Technology, Cambridge). Bell J. Econ.; 10: No. 1, 271-281(Spr 1979).
Railroads and utilities bargain over rates for hauling coal, with the price of alternative fuels historically serving to limit those rates. Recently, these limits have been raised by regulation-induced shortages in natural gas, cartel-induced price rises for oil, and environmental opposition to nuclear power. Estimates of the rate-making process are modeled to see how the process has responded to increased prices of alternative fuels. The results indicate that railroads have been moderately successful in taking advantage of these higher prices. However, their success is increasingly leading to challenges before the Interstate Commerce Commission. 8 references.

114 COAL TRANSPORTATION MODELS: THE USE, MISUSE, AND ABUSE OF DATA. Rieber, M. (Univ. of Arizona, Tucson). Growth and Change; 10: No. 1, 130-136(Jan 1979).
Coal transportation models are compared in terms of their capacity to accurately state transport costs, which are central to coal utilization. Two types of models are discussed briefly: (1) network (the Bechtel--Stanford Research Institute and Manalytics models); and (2) comparative-cost analysis of transport systems over specific routes and using different modes, such as unit train, slurry pipeline, barge, truck, or conveyor belt. The comparative-cost models require more reliable engineering and cost data. Cost comparisons are developed and a variety of problems, both economic and engineering, identified, with the suggestion that cooperation between the two disciplines is necessary for the problems to be solved. 10 references. (DCK)

115 IMPACT OF COAL LABOR DISPUTES AND FUTURE CONSIDERATIONS ON THE REST OF THE MINERALS INDUSTRY. Brennan, J. Mater. Soc.; 3: No. 1, 43-52(1979).
Mr. Brennan feels that the lessons to be learned from the 1978 coal miners' strike can be applied to the metals industry. At stake was whether national collective bargaining and the United Mineworkers of America as a bargaining agent could survive. The coal industry also demanded contract language to eliminate wildcat strikes and an understanding that increased productivity would benefit both parties. A review of the negotiating process points out how government intrusion into collective bargaining made industry and labor join forces to insist on the right to negotiate without interference. Important features of the new contract include a Joint Industry Development Committee, provision for a bonus system at individual mines, a provision allowing mine foremen to settle a complaint without setting a precedent, and a shift in the medical benefits program to help miners identify with the company. Whether the new provisions can help to cope with the socio-economic problems of expanded coal production and with the coal market situation may depend on whether the minerals industry takes positive action in dealing with people and becomes more sophisticated in labor relations, according to Mr. Brennan.

116 POLICIES AND CONSTRAINTS FOR MAJOR EXPANSION OF US COAL PRODUCTION AND UTILIZATION. Hibbard, W.R. Jr. (Virginia Polytechnic Inst. and State Univ., Blacksburg). Annu. Rev. Energy; 4: 147-174(1979).
Various government policies and constraints are examined to see why coal production and use declined in 1978 in spite of earlier predictions of a doubling by 1985. The coal industry, with a long-term supply in excess of demand, had a history of low-margin cycles and has only recently improved its profitability. The industry claims the goals can be met with available manpower and equipment except for the laws regulating coal-mining operations, environmental restrictions, coal transport, and land use. The costs of these constraints are reflected in higher production costs and longer lead times, while any benefits of either the constraints or the incentives to use coal remain unknown quantities. This is true partly because many of the environmental limits have been set without persuasive evidence. 24 references.

117 COAL-SLURRY-PIPELINE SAVINGS DOUBTED: SEEN COMPETITIVE AT BEST. Feder, B.J. Energy User News; 3: No. 44, 16(30 Oct 1978).
The prevailing theme recently at the Transportation Research Forum's session on coal transportation was that slurry pipelines, at best, would be competitive with but no cheaper than rail transport for western coals. Touted as a way to cut coal-use costs, slurry pipelines appear to have the economic advantage of low operating costs, less vulnerability to inflation and labor disputes, better safety, and less environmental impact. Critics say the high capital costs, water requirements, sludge disposal problems, inadequate demand, as well as the associated regulatory, legal, and financial problems will eliminate any cost advantage. More information is needed to eliminate many of the economic and natural uncertainties, while political and legal complications appear to be even more critical.

118 ROLE OF COAL: PROBLEMS AND POLICIES. Moyer, R. (Univ. of California, Berkeley). Nat. Resour. J.; 18: No. 4, 761-774(Oct 1978).
Changes in coal development are both favorable and disruptive, as in the increasing tendency for government intervention. The coal industry's assets include a government commitment to coal utilization, although conflicting policies make it difficult to increase production and consumption. While coal is the logical resource to emphasize on the basis of reserves and cost advantages, major problems remain for preserving air quality standards, present restrictions on mining leases on western lands, a downward trend in productivity, labor uncertainties, pressures to enforce horizontal divestiture, and others. A number of firms have, nevertheless, invested in coal companies after assessing the pros and cons with the expectation of making a profit. 18 references and footnotes.

119 ECONOMICS OF COAL SLURRY PIPELINING: TRANSPORTATION AND NON-TRANSPORTATION FACTORS. Farris, M.T.; Shrock, D.L. (Arizona State Univ., Tempe). Transport. J.; 18: No. 1, 45-57(Fal 1978).
There are three possible situations where slurry pipelining might be adopted for coal movement. These involve various combinations of geographic, economic, and institutional conditions. In virtually all instances, the issues come down to a question of use of slurry pipelines vs. use of railroads for coal movement. Other alternatives for coal movement, such as use of trucks for short-haul moves or use of waterways for long hauls, are generally not relevant. In the U.S., proposed source/use combinations for coal-based energy resources generally preclude these further alternatives: due to total volume or distance requirements, in the former case, or lack of available

navigable waterways along desired transportation routes, in the latter case. A map shows the general source/use relationships pertinent to potential use of slurry pipelines for coal movement. The three basic sets of conditions for analysis dictated by these relationships are presented. The first situation involves exploitation of coal reserves that are not currently accessible by existing transportation systems and where geographic conditions preclude the construction of railroads, either technically or economically. The second basic situation occurs when there is a potentially suitable railroad system available between the coal source and its destination and there are no barriers to slurry pipeline construction. The third situation occurs when there are no existing transportation systems available for the movement of the resource and there are no obvious barriers to construction of either slurry pipelines or railroads. A fourth situation exists involving the potential construction of a slurry pipeline versus some new railroad construction required to meet an existing railroad system. This case is a hybrid of the second and third cases, requiring analysis of similar factors, and will not be discussed. All aspects of the cases are examined and conclusions drawn. (MCW)

120 SOCIAL AND ECONOMIC IMPACTS OF INCREASED COAL PRODUCTION. Canfield, M. Jr. (General Accounting Office, Washington, DC). Energy (Stamford, Conn.); 3: No. 4, 22-24(Fal 1978).

To cope with the socio-economic impacts of population growth and urbanization associated with energy development, specifically coal production, state and local governments will need advance information to prepare for adequate additional facilities and services and they will need front-end funds to provide these facilities and services before the new people arrive. An influx of new workers will bring new ideas, values, and behavior patterns to communities. This article reviews steps being taken at local, state, and federal levels and by industry to resolve these problems.

121 COAL TRANSPORTATION RESEARCH AND INFORMATION NEEDS. Eck, R.W. (West Virginia Univ., Morgantown); Hui, C.Y. Transp. Eng. J.; 104: No. TE5, 757-767(Sep 1978).

This paper examines some of the existing and emerging issues of interest to engineers and planners dealing with coal transportation. One conclusion is that any research or data collection efforts in this field must be of a multidisciplinary nature. Not only must transportation planners, highway engineers, maintenance engineers, and soils engineers work together but, in addition, engineers will need to work with geologists, economists, and marketing specialists for effective planning, design, and operation of the coal transportation system. Earlier sections of this paper may have given the erroneous impression that all future research should concentrate on problems of transporting coal by truck. Although the West Virginia coal conversion study documented information deficiencies relative to the highway transportation of coal, research efforts involving railroads and waterways should continue. There is a serious need for research and information relative to the interactions between modes. For example, in order to predict the impact of local coal conversions on rail and barge systems that serve retailers, it is necessary to have a knowledge of the typical volumes that would be required by retail facilities, frequency of delivery to retail yards, and transportation distances involved mine and retailer. This paper deals with relatively short-term planning, however, information is required on the long-range future of the coal industry. Decision makers involved with providing an adequate coal transportation system must have information on the future role that coal will play in United States energy policy. (MCW)

122 PROSPECT FOR OCCUPATIONAL BOTTLENECKS IN THE COAL INDUSTRY. Hannah, R.L. (Univ. of Utah, Salt Lake City). Int. Econ. Rev.; 9: No. 1, 78-82(Spr 1978).

With the National Energy Plan calling for doubling of coal production by 1985, coal mining employment also will need to be essentially doubled, if productivity is to remain constant. An investigation was performed to determine what occupational classifications are bottlenecks in Region VIII of the western states; no bottlenecks were perceived in the construction phase of the industry. Although an excessive number of construction projects underway at the same time could cause strain, the union referral system is performing its function of supplying needed construction workers in Region VIII. The more fundamental problem in power-plant construction lies in the special characteristics of seasonal fluctuation and the state of uncertainty due to legal actions by environmentalists and pending court decisions. Occupations presently identified as bottlenecks involve underground and surface miners and operation/maintenance personnel for power plants. All of these require long training periods. The importance of improving the quality of life in a community that is expanding is stressed. This reduces worker turnover. (MCW)

123 QUESTION MARK OVER COAL. POLLUTION, POLITICS, AND CO. Marland, G.; Rotty, R.M. (Oak Ridge Assoc Univ, Inst for Energy Anal, Tenn). Futures; 10: No. 1, 21-30(Feb 1978).

The increasing concentration of carbon dioxide (CO_2) in the atmosphere is now well-documented, and although the evidence of actual or potential climate changes is not conclusive, the growth in energy consumption magnifies the importance of the possible dangers. The CO_2 increase will be mainly produced by coal, and the indications are that many countries will be contributing to the increase in atmospheric CO_2 early in the next century. Using world energy resource estimates and projections of the global production of CO_2 from fossil-fuel burning in the year 2025, the paper argues that it will be difficult to achieve an international consensus and commitment to deal with the issue. This is because of the relationship between economic growth, industrialization, and the production of CO_2, and because of the distribution of the beneficial and harmful effects of any climatic change. 28 refs.

124 ENVIRONMENTAL IMPACTS OF COAL SLURRY PIPELINES AND UNIT TRAINS. Rogozen, M.B.; Margler, L.W. (Sci Appl, Inc, Los Angeles, Calif). pp 228-240 of Greater Los Angeles Area energy symposium. North Hollywood, CA; West Period Co. (1978).

From 4. energy symposium; Los Angeles, CA, USA (23 May 1978).

SAI recently evaluated the environmental impacts of coal slurry pipelines and coal unit trains for the U.S. Congress, Office of Technology Assessment. Both the general impacts of each technology and the impacts of hypothetical cases were evaluated. Results of this study are presented here with emphasis on

the Utah-to-Southern California hypothetical case. It is shown that the coal slurry pipeline water requirement is so small in comparison with even the lowest flows in the Green River that no significant direct environmental impacts would be anticipated. Permanent removal of water from the Basin by a slurry pipeline would preclude some growth in alternative uses. The most likely re-use of recovered coal slurry pipeline water in the Barstow area would be as power plant cooling system makeup. Because the pipeline would largely bypass population centers, the major impact would be upon rural land use, which is primarily grazing land and open space. 33 refs.

125 WHERE WE AGREE: REPORT OF THE NATIONAL COAL POLICY PROJECT. SUMMARY AND SYNTHESIS. Washington, DC; Automated Graphic System (1978). 84p.

The National Coal Policy Project concludes and recommends that: Coal can be mined without unacceptable long-term damage to the environment. The proper pricing of energy, including the internalization of associated environmental and social costs, is needed to avoid uneconomical use of energy and unacceptable impacts. Accordingly, in the near term, electricity prices should reflect marginal cost analysis within regulatory commission-determined revenue requirements. No one class of users should subsidize another. Major coal-burning power plants should be located in the general areas where the energy is to be distributed, and not in remote regions. The Environmental Protection Agency (EPA) should be given the authority to allow a limited number of exceptions from the New Source Performance Standards and Best Available Control Technology requirements of the Clean Air Act in order to encourage the development and use of innovative combustion and pollution abatement technology. Utility siting statutes should be adopted by state governments to encourage rational and fair site selection and to streamline the application procedure for new power plants. Economic regulation by government of the transportation sector should be sharply curtailed. Specific recommendations are made with respect to railways, slurry pipelines and waterways. Such subsidies disguise the true cost of energy and lead to its uneconomical use. Mandatory coal conversion orders should exempt small units, encourage the use of cleaner and more efficient coal-using technology, and be aimed primarily at those units which previously burned coal.

126 LEGISLATIVE ASPECTS OF COAL-SLURRY PIPELINES. Udall, M.K. (US House of Representatives, Washington, DC). pp 142-146 of Proceedings of the 3rd international technical conference on slurry transportation. Washington, DC; Slurry Transport Association (1978).

From 3. international technical conference on slurry transportation; Las Vegas, NV, USA (29 Mar 1978).

Representative Morris Udall delivered a luncheon address describing some of the history of a bill, currently in the House of Representatives, that would give slurry pipelines the right of eminent domain. As the chairman of the Committee on Interior and Insular Affairs, he has been a leader in getting the slurry pipeline bill to the House floor. Representative Udall gave his opinions on wide-ranging energy issues.

127 RESOURCE TAXATION, TAX EXPORTATION, AND REGIONAL ENERGY POLICIES. Shelton, R.B.; Morgan, W.E. (Univ. of Wyoming, Laramie). Nat. Resour. J.; 17: No. 2, 261-282(Apr 1977).

An analysis of energy policies and natural resource taxes, specifically severance taxes on coal, in the Rocky Mountain Region examines how public policies can be used to achieve alternative economic objectives. Over 42 percent of the country's coal reserves are located in six states, which vary in the extent of their reserves, production, and export and disagree on the use and importence of coal taxes. Severance taxes and a combination of severance and property taxes are considered in a model of three states covering a range of coal supply and demand. A comparison of the results with the current situation in the Rocky Mountain Region considers the effectiveness of a uniform taxing cartel in maximizing total tax revenue and constraining tax exportation. Severance taxes are seen to accomplish the objectives of states with high production levels but create instability for the region because of the need to rely on property taxes in the states having less coal production. (DCK)

128 COAL INDUSTRY IN AMERICA. A BIBLIOGRAPHY AND GUIDE TO STUDIES. Munn, R.F. Morgantown, WV; West Virginia University Library (1977). 355p. $16.00.

It is clearly desirable that research on the coal industry and the problems associated with it be carried on as efficiently and intelligently as possible. Unfortunately, the scattered nature of the literature militates against this. Even the most conscientious scholar finds it increasingly difficult to keep abreast of the literature in his own field. It is generally quite impossible for him to follow that of other disciplines. Thus it is idle to expect the sociologist to scan medical journals or the economist to master the literature of psychology. And yet, it seems clear that fruitful study of many of the problems associated with the coal industry must utilize a multi-disciplinary approach. The chief purpose of this guide is to aid in such multi-disciplinary research. The principal emphasis has been placed on the social sciences. The enormous body of literature in the science and technology of mining is outside the scope of this work. Titles dealing with technology and geology are included only if they contain a significant amount of material of potential interest to the historian or social scientist. Every effort has been made to include titles of real significance and works whose bibliographies will serve as a guide to those interested in a specific area or problem.

129 UNITED MINE WORKERS AND THE DEMAND FOR COAL: AN ECONOMETRIC ANALYSIS OF UNION BEHAVIOR. Farber, H.S. Princeton, NJ; Princeton Univ. (1977). 190p. University Microfilms Order No. 77-28,121.

Thesis (Ph. D.).

In this study a model of union behavior applicable to the United Mine Workers (UMW) was developed and estimated in order to analyze the response of the union to shifts in the demand for coal. Each member of the UMW was assumed to have a utility function which was a function of the present discounted value of his income over his lifetime. It was further assumed that each member of the union had a well-defined probability of being employed in a union mine, which was a function of the overall level of union mine employment. When combined with a certainty-equivalent alternative level of discounted earnings, the utility function and probability function yielded the expected utility of the union members as a function of

the union wage rate, ton tax, level of union employment, and output from union mines. The expected utility function differed across the membership only by the age of each member. The individual preferences were aggregated into a union preference function by assuming that the leaders of the UMW want to minimize the risk that they will lose their offices. This implies that they set the wage rate and ton tax so as to maximize the expected utility of the median-aged member of the UMW. In order to estimate the parameters of the utility function, expressions determining labor demand, coal demand, the price of coal, and the extent of unionization in the coal industry were specified and estimated. The model was estimated by Full Information Maximum Likelihood using time-series data for 1947 through 1973.

130 COAL SEVERANCE TAXATION. Mortensen, R.W. Salt Lake City, UT; Univ. of Utah (1977). 230p. University Microfilms Order No. 77-11,258.
Thesis (Ph. D.).
The purpose of this study was to determine what factors were associated with the enactment of coal severance tax legislation and to explain why, given apparently similar coal resources, some states have chosen to enact coal severance taxes while others have not. The study reviewed the concept of severance taxation and summarized on a state-by-state basis, the existing coal severance tax statutes, traced the growth and development of the coal industry, and presented projections of future coal development. The study concluded that those states which had record levels of coal production, which exported much of their coal, which anticipated rapid industry expansion, and a Governor who supported coal severance taxes were the most likely to enact coal severance tax legislation. However, while it was possible to determine the general characteristics associated with the enactment of coal severance taxes, it was not possible to predict when such tax legislation would be enacted due to the unique political variables present in the various states.

131 FALKIE CALLS MANPOWER PROBLEM COAL'S ACHILLES' HEEL. Collett, H. Coal Min. Process.; 12: No. 5, 56-57; 62-63(May 1975).
MEETINGS;PERSONNEL;COAL;FORECASTING; LEGISLATION;COAL INDUSTRY;REGULATIONS;GEOLOGY; EQUIPMENT;SAFETY;MARKET;ECONOMICS;SURFACE MINING;ENERGY SHORTAGES;ENVIRONMENTAL EFFECTS; NUCLEAR POWER;EDUCATION;MINERS

General

132 (DOE/EIA/10496--1) TAXONOMY OF ENERGY TAXES. (National Academy of Sciences, Washington, DC (USA)). Sep 1979. Contract AC01-79EI10496. 48p. Dep. NTIS, PC A03/MF A01.
This report provides the US DOE with a taxonomy of the direct Federal, state, and local taxes that differentially affect energy markets, including features of general taxes that affect energy differentially; and describes some of the important analytical questions associated with the taxes included in the taxonomy. First, the report discusses energy taxation within the broad context of energy production and use. The second part includes the formal taxonomy and a detailed breakdown of energy taxes by taxing authority and suggests the important issues that are likely to arise in an analysis of energy taxation.

133 (ORNL/TM--5890/S5) ENERGY AVAILABILITIES FOR STATE AND LOCAL DEVELOPMENT: PROJECTED ENERGY PATTERNS FOR 1985 AND 1990. Vogt, D.P.; Rice, P.L.; Corey, T.A.; Pai, V.P. (Oak Ridge National Lab., TN (USA)). Nov 1979. Contract W-7405-ENG-26. 567p. Dep. NTIS, PC A24/MF A01.
This report (one of a series) presents projections of the energy supply, demand, and net imports of seven fuel types (gasoline, distillates, residual oil, crude, natural gas, coal, electricity) and four final consuming sectors. To facilitate detailed regional analysis these projections have been prepared for Bureau of Economic Analysis (BEA) areas, states, census regions, and the nation for 1985 and 1990. The data are formatted to present regional energy availability from primary extraction, as well as from energy-transformation processes. The tables depict energy balances between availability and use for each specific fuel. The objective of this series is to provide a consistent base of historic and projected energy information within a standard format. Such a framework should aid regional policymakers in their consideration of regional growth issues that may be influenced by the regional energy system. However, for analysis of specific regions, this basic data should be supplemented by additional information which only the local policy analyst can bring to bear in his or her assessment of the energy conditions that characterize the region. Earlier volumes in this series have proved useful for both specific and general analysis of this type, and it is hoped that the current volume will prove equally so. This volume presents an updated benchmark projection series, which captures recent developments in the business as usual projections of energy supply and consumption due to national policy developments since the 1976 National Energy Outlook projection series were prepared.

134 (UWRL-P--78-005) IMPACT OF ENERGY RESOURCE DEVELOPMENT ON WATER RESOURCE ALLOCATIONS. Keith, J.E.; Turna, K.S.; Padunchai, S.; Narayanan, R. (Utah State Univ., Logan (USA). Utah Water Research Lab.). May 1978. 109p. Utah State Univ., Logan.
This research used a linear-programming model of the agricultural and energy sectors of Utah to examine the economically efficient allocation of water between agriculture and energy. Data were collected for agricultural returns, costs, and water requirements; energy returns, costs, and water requirements; and water supply costs. Results indicate that if large-scale energy development occurs in the Colorado River Basin in Utah, most of irrigated agriculture will be eliminated, given Utah's consumptive-use constraint under the Upper Colorado River Compact. On the other hand, for two more probable levels of energy development, including the Energy Research and Development Administration's projections for the year 2000, only minor reductions in irrigated acreages would be expected. Under conditions of severe, prolonged drought, energy demands would consume almost all the water currently used in agriculture, given either of the probable scenarios.

135 WATER AND POWER TRENDS: 1980 REPORT AND FORECAST. SPOTLIGHT SHIFTING TO ENERGY GROWTH. Eng. News-Rec.; 204: No. 3, 108-110, 112, 116, 118, 120(17 Jan 1980).
The country opened the 70's decade (when

energy was very cheap and plentiful) with a vigorous push for greater environmental protection of air, land, and water. Progress has been made in air and water quality, but at a costly price, one that has generated new concern for where tax dollars can best be spent. Energy is no longer cheap and plentiful, of course, and the new decade is likely to bring a closer scrutiny and balancing of environmental goals and energy demands. The 80s will be a telling decade for alternative energy programs - from photovoltaics and wind power to biomass and small hydro. Such renewable resource programs are having success producing technology that works, but it is uncertain when the technology will be economically competitive in the commercial marketplace. A tabular listing of water and power major projects is presented under the following topics: power projects, nuclear; power projects, fossil; alternative energy; dam, flood control, navigation, water supply; pollution control projects; and solid waste, resource recovery. (MCW)

136 ENERGY PROJECTIONS: OIL, NATURAL GAS, AND COAL IN THE USSR AND EASTERN EUROPE. Hoffman, G.W. (Univ. of Texas, Austin). Energy Policy; 7: No. 3, 232-241(Sep 1979).

There have been many projections of energy supply and demand for the USSR and Eastern Europe, but little agreement on future trends. In this article, Dr. Hoffman assembles a variety of published forecasts of Soviet and Eastern European energy production, consumption, imports, and exports. This allows comparison of the available data sources and illustrates the range of estimates for gas, coal, oil, and nuclear power. The author also outlines the Soviet and Eastern European energy resource base and provides an extensive bibliography with 80 references.

137 SULFUR, ENERGY, AND ENVIRONMENT. Meyer, B. New York; Elsevier North-Holland Inc. (1977). 459p. $39.75.

The Introduction correlates traditions and trends in the fields of sulfur, energy use, and environmental attitude, and delineates the role of chemistry. Chapter 2 sketches a short history of sulfur chemistry. Chapter 3 reviews the chemical properties of the element and some of its most important compounds. Chapter 4 indicates common analytical methods and some problems encountered in their use. Chapter 5 provides a short list of sulfur sources and reserves. Chapter 6 reviews recent work on the four most important sulfur cycles. Chapter 7 summarizes sulfur production methods, and Chapter 8 describes coal combustion chemistry and flue-gas desulfurization efforts. Chapter 9 describes some of the problems that occur at the interfaces of science, industry, and society. Chapters 10 through 14 deal with the use of sulfur in medicine, agriculture, chemical industry, the plastics industry, and in other applications. The final Chapter discusses possible future trends in sulfur production, use, and recovery, and the role of chemistry, government, and education in these areas. This book serves as a guide to the literature in fourteen areas; the bibliography contains 1600 references.

138 ENERGY: MYTHS AND REALITIES. Stamford, CT; Business Communications Co., Inc. (1977). 291p. (CONF-771107--). Business Communications Co., Inc., 9 Viaduct Rd. Box 2070C, Stamford, CT.

From 1. annual international conference on energy; Washington, DC, USA (8 Nov 1977).

Twenty-nine papers are presented dealing with every aspect of energy except fusion, which the editor deems to be ''down the road a piece''. He states that some analysts peg the capital-investment requirements to be spent by the U.S. in producing, transporting, and controlling energy at about $100 billion a year and that the presentation of these papers by experts from industry and government will aid in understanding this situation. Practically all energy sources--conventional and unconventional--come in for some discussion, along with energy storage, energy conservation, government policies, etc. (MCW)

CORPORATE INDEX

In the Corporate Index, report literature is indexed using the name of the organization or institution responsible for issuing the report. Headings are provided for all report literature and for published literature for which a corporate approach is especially desirable, e.g., symposium and conference proceedings.

Each entry under a corporate heading gives the report title and the volume and abstract numbers. Report numbers, if applicable, are given in parentheses at the end of the entry.

DOE Energy Information Data Base: Corporate Author Entries (TID-4585) is used in the standardization of corporate entries. TID-4585 is available for purchase from the National Technical Information Service (NTIS), U. S. Department of Commerce, Springfield, Virginia 22161.

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The title may be supplemented with additional words, or a phrase, if it appears additional information would be helpful. In cases for which the title contains little or no information related to the subject entry, it may be replaced entirely by the supplementary information. A qualifier is not always required, and in such cases the title will follow the unqualified subject descriptor.

The descriptors selected for use as subject terms are generally the names of specific materials, things, or processes. To the extent possible, a qualifier is selected to describe the properties of, or processes applied to, the subject term.

Index entries are selected to indicate the important ideas and concepts presented in the report, rather than words that may appear in the text. Within the available thesaurus terms, the most probable or logical place to look for typical information is selected. ''See references'' are included to guide users from synonymous terms or phrases to the descriptor selected as a subject heading for the concept. (e.g. Pipeline Quality Gas see HIGH BTU GAS). ''See also references'' are used to indicate where to find references to subject concepts that are narrower, broader, or related to a particular subject heading. to complete an exhaustive search of a given subject, all such headings should be reviewed.

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A15	18.00	E15	36.50	T15	960.00
A16	19.00	E16	39.50	T16	1,020.00
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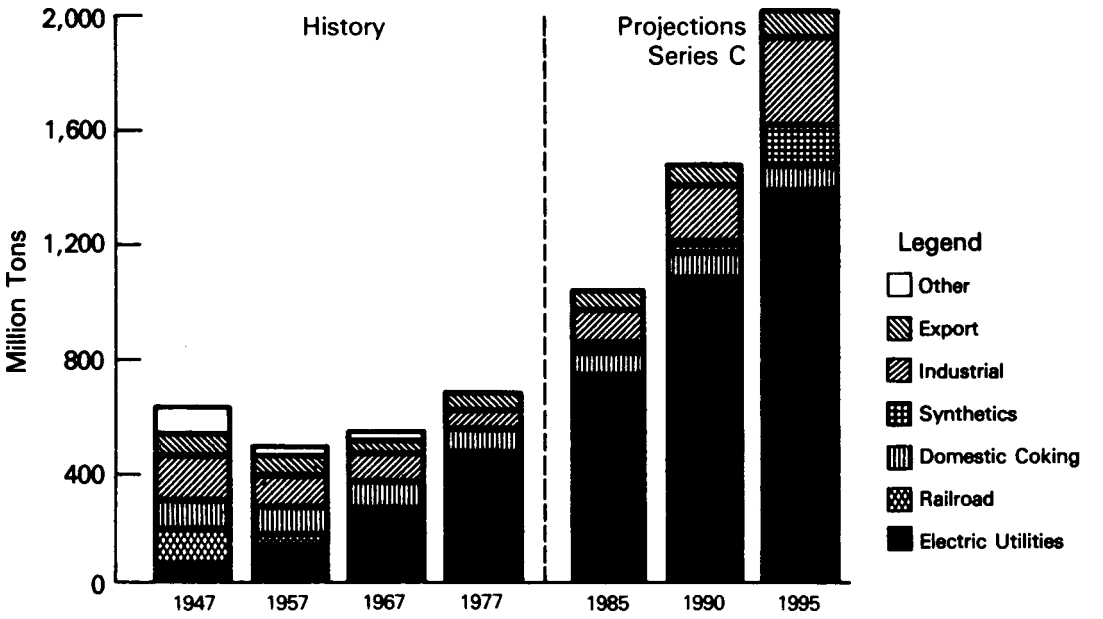
APPENDIX

Coal Production and Disposition Data

The tables and figures presented in this section are from publications of the Energy Information Administration (EIA). They were identified using the FEDEX data base. This data base, developed by the Office of Energy Information Services of the EIA, in cooperation with the Technical Information Center, contains abstracts with indexing at the table and graph level for all ongoing statistical publications and at the document level for all publications of the EIA. It is possible to go directly from a FEDEX listing or index to the exact table or graph containing the data required.



Coal's Changing Market, 1947-1995

International Coal Production, 1975–1978
(Million Short Tons)

Area Country	1975	1976	1977	1978[1]
North, Central, and South America				
United States				
Anthracite	6	6	6	5
Bituminous	629	653	663	629
Lignite	20	25	28	36
Canada				
Anthracite	([2])	([2])	([2])	([2])
Bituminous	24	23	25	28
Lignite	4	5	6	6
Other				
Anthracite	([2])	([2])	([2])	([2])
Bituminous	15	16	17	17
Total				
Anthracite	6	6	6	5
Bituminous	667	692	702	674
Lignite	24	31	35	42
Africa				
South Africa, Republic of				
Anthracite	2	2	3	2
Bituminous	75	82	91	97
Other				
Anthracite	1	1	1	1
Bituminous	5	6	6	6
Total				
Anthracite	2	3	3	3
Bituminous	80	88	97	103
Near East and Far East				
China, Peoples Republic of				
Anthracite, Bituminous and Lignite	518	529	606	681
India				
Bituminous	106	111	111	112
Lignite	3	4	4	4
Other				
Anthracite	59	60	59	61
Bituminous[3]	38	38	40	40
Lignite[3]	12	12	12	14
Total				
Anthracite, Bituminous and Lignite	518	529	606	681
Anthracite	59	60	59	61
Bituminous[3]	145	150	151	152
Lignite[3]	14	15	16	18
Western Europe				
Germany, West				
Anthracite	8	7	6	6
Bituminous	93	91	87	87
Lignite	136	148	135	136
United Kingdom				
Anthracite	3	3	3	3
Bituminous	139	134	132	133
Western Europe (continued)				
Yugoslavia				
Bituminous	6	6	6	5
Lignite	39	40	41	43
Other				
Anthracite	12	11	10	10
Bituminous	34	34	35	33
Lignite	33	38	41	41
Total				
Anthracite	23	21	19	19
Bituminous	272	265	260	258
Lignite	209	226	217	220
Eastern Europe and U.S.S.R.				
Czechoslovakia				
Bituminous	31	31	31	31
Lignite	96	99	100	105
Germany, East				
Bituminous	([2])	([2])	([2])	([2])
Lignite	272	272	280	279
Poland				
Bituminous	189	198	205	212
Lignite	44	43	45	45
U.S.S.R.[3]				
Anthracite	85	86	87	87
Bituminous	507	518	527	530
Lignite	180	180	184	186
Other				
Anthracite	([2])	([2])	([2])	([2])
Bituminous	12	11	11	12
Lignite	77	73	75	75
Total[3]				
Anthracite	85	86	87	87
Bituminous	739	759	775	785
Lignite	669	677	684	691
Oceania				
Australia				
Bituminous	74	83	86	88
Lignite	31	34	32	36
Other				
Bituminous	3	3	3	2
Lignite	([2])	([2])	([2])	([2])
Total				
Bituminous	76	85	89	90
Lignite	31	34	32	36
World Total				
Anthracite, Bituminous and Lignite	518	529	606	680
Anthracite[3]	174	175	174	176
Bituminous[3]	1,978	2,032	2,074	2,062
Lignite[3]	947	984	985	1,007
Total, all grades	3,617	3,720	3,839	3,925

[1] Preliminary. [2] Less than 500,000 short tons. [3] Estimate.

Note: Sum of components may not equal totals due to independent rounding.

Sources: • 1975 and 1976—U.S. Department of Interior, Bureau of Mines, Office of Technical Services and various statistical publications and reports of individual countries. • 1977 and 1978—United Nations, Department of International Economic and Social Affairs, Statistical Office, Monthly Bulletin of Statistics, February 1980, and various statistical publications and reports of individual countries.

Coal Supply and Disposition, 1949–1979
(Million Short Tons)

	Supply						Disposition		
	Production								
Year	Underground	Surface	Total	Imports	Change in Consumers' Stocks, Losses, and Unaccounted for[1]	Total	Exports[2]	Consumption	Total
1949	358.9	121.7	480.6	0.3	35.1	516.0	32.8	483.2	516.0
1950	421.0	139.4	560.4	0.4	−37.3	523.5	29.4	494.1	523.5
1951	442.2	134.2	576.3	0.3	−8.1	568.6	62.7	505.9	568.6
1952	381.2	126.3	507.4	0.3	−1.4	506.3	52.2	454.1	506.3
1953	367.4	120.8	488.2	0.3	2.8	491.3	36.5	454.8	491.3
1954	306.0	114.8	420.8	0.2	2.8	423.8	33.9	389.9	423.8
1955	358.0	132.9	490.8	0.3	10.3	501.4	54.4	447.0	501.4
1956	380.8	148.9	529.8	0.4	0.5	530.7	73.8	456.9	530.7
1957	373.6	144.5	518.0	0.4	−3.2	515.2	80.8	434.5	515.3
1958	297.6	134.0	431.6	0.3	6.4	438.3	52.6	385.7	438.3
1959	292.8	139.8	432.7	0.4	−9.0	424.1	39.0	385.1	424.1
1960	292.6	141.7	434.3	0.3	1.4	436.0	38.0	398.0	436.0
1961	279.6	140.9	420.4	0.2	6.1	426.7	36.4	390.3	426.7
1962	287.9	151.1	439.0	0.2	4.1	443.3	41.2	402.2	443.3
1963	309.0	168.2	477.2	0.3	−2.7	474.8	51.3	423.5	474.8
1964	327.7	176.5	504.2	0.3	−7.9	496.6	50.9	445.7	496.6
1965	338.0	189.0	527.0	0.2	−3.0	524.1	52.2	472.0	524.1
1966	342.6	204.2	546.8	0.2	1.6	548.6	50.8	497.7	548.6
1967	352.4	212.5	564.9	0.2	−22.7	542.4	51.0	491.4	542.4
1968	346.6	210.1	556.7	0.2	4.9	561.8	52.0	509.8	561.8
1969	349.2	221.7	571.0	0.1	3.2	574.3	57.9	516.4	574.3
1970	340.5	272.1	612.7	(3)	−17.0	595.7	72.4	523.2	595.7
1971	277.2	283.7	560.9	0.1	−1.4	559.6	58.0	494.2	552.3
1972	305.0	297.4	602.5	(3)	−21.1	581.5	57.2	524.3	581.5
1973	300.1	298.5	598.6	0.1	17.9	616.6	54.0	562.6	616.6
1974	278.0	332.1	610.0	2.1	7.4	619.5	61.1	558.4	619.5
1975	293.5	361.2	654.6	0.9	−26.2	629.4	66.8	562.6	629.4
1976	295.5	389.4	684.9	1.2	−21.7	664.4	60.6	603.8	664.4
1977	266.6	430.6	697.2	1.6	−18.8	680.0	54.7	625.3	680.0
1978	242.8	427.4	670.2	3.0	−7.0	666.2	41.0	625.2	666.2
1979[4]	302.0	473.7	775.8	2.1	−30.6	747.2	66.3	680.9	747.2

[1] Includes changes in stocks at electric utilities, coke plants, other industries, and retail dealers and the balancing item of losses and unaccounted for. Net additions to stocks are considered as negative numbers.

[2] Includes small quantities of anthracite shipped overseas to U.S. Armed Forces.

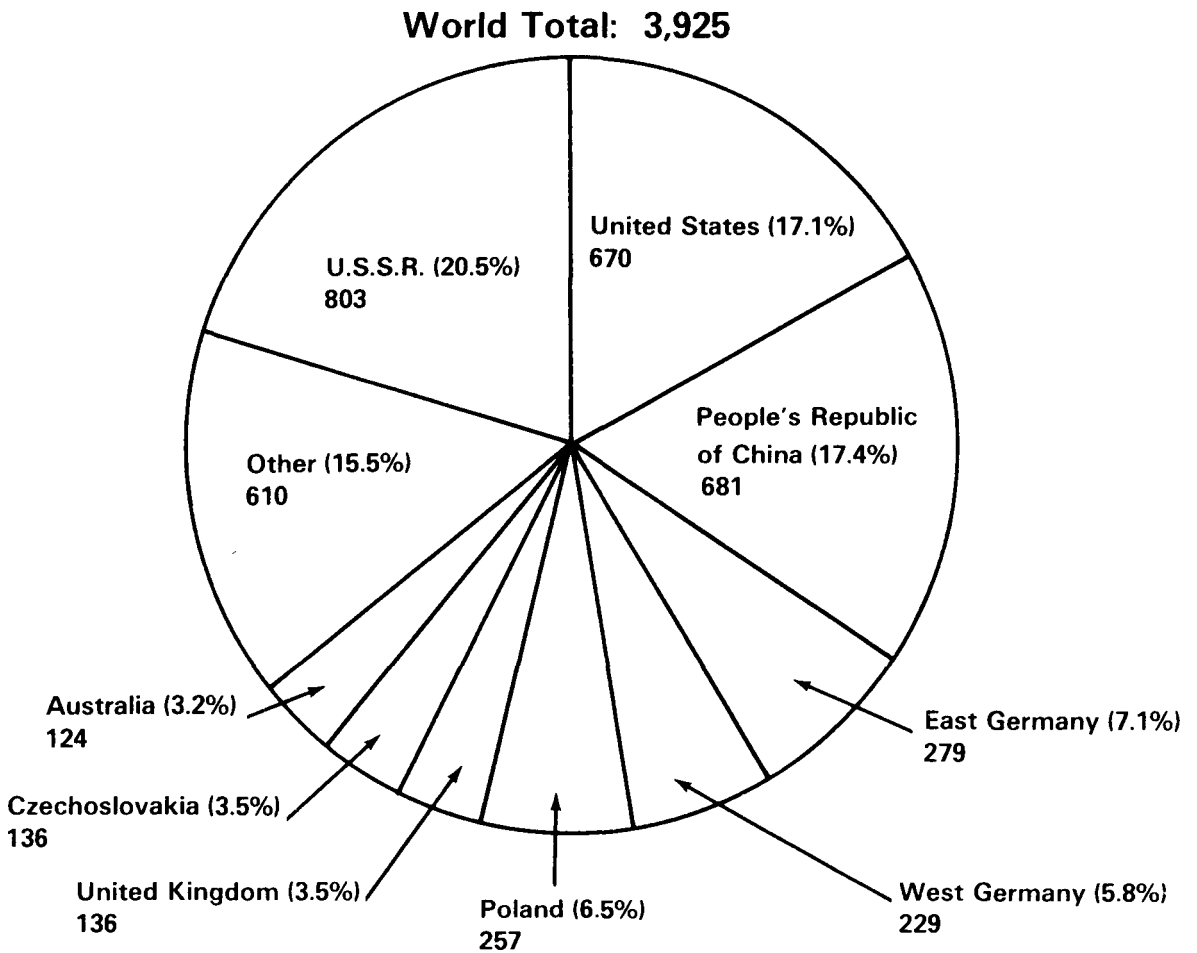
[3] Less than 0.05 million short tons.

[4] Preliminary.

Note: Sum of components may not equal total due to independent rounding.

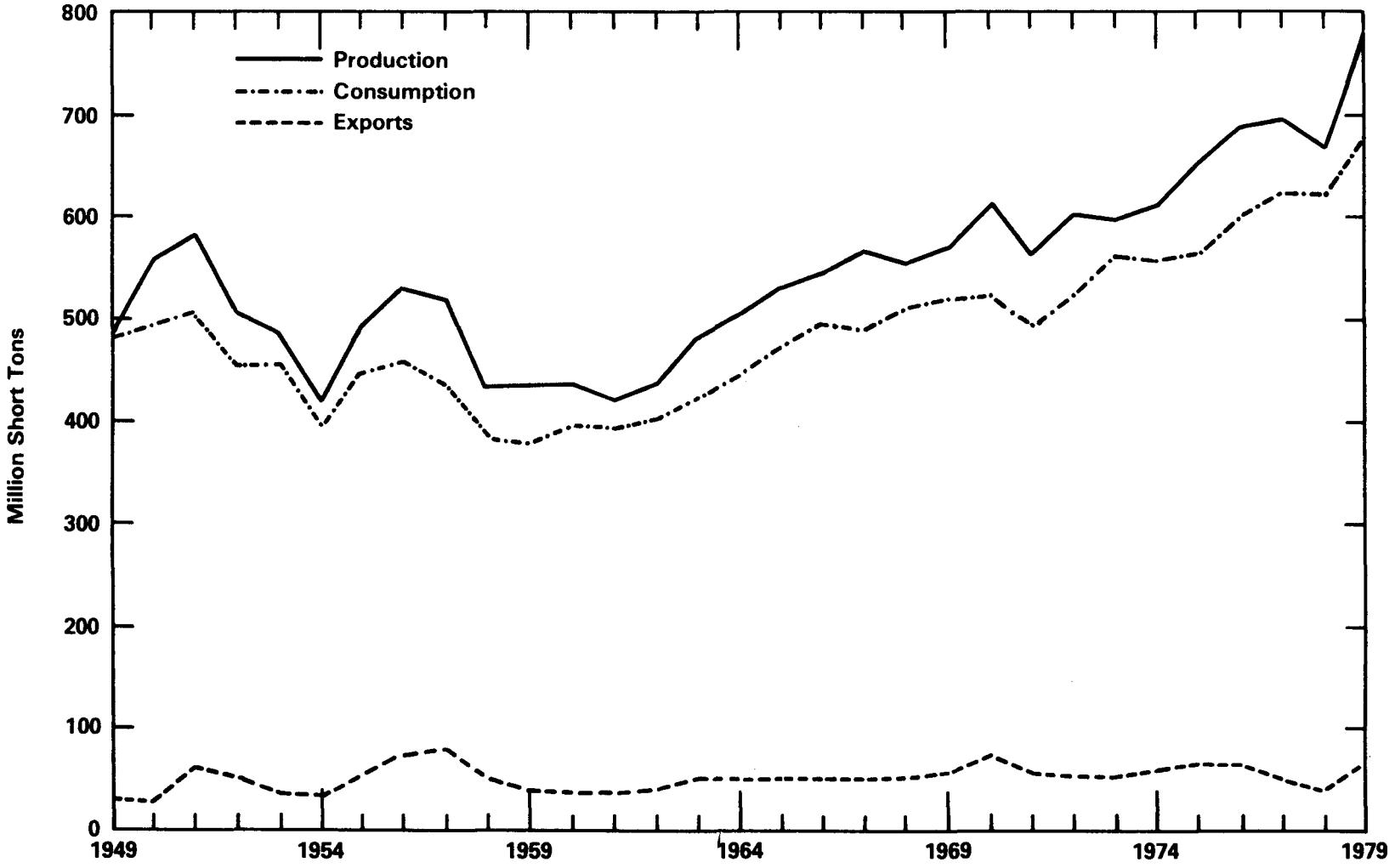
Sources: • 1949 through 1975—U.S. Department of the Interior, Bureau of Mines, *Minerals Yearbook*, "Bituminous Coal and Lignite" chapter; Federal Power Commission, Form 4, *Monthly Power Plant Report*. U.S. Department of the Interior, Bureau of Mines, *Minerals Yearbook*, "Coal—Pennsylvania Anthracite" chapter. • 1976 through 1979—U.S. Department of Energy, Energy Information Administration, *Production of Coal, Bituminous and Lignite*, weekly. U.S. Department of Energy, Energy Information Administration, Federal Power Commission, Form 4, *Monthly Power Plant Report*.

International Coal Production, 1978
(Million Short Tons)



World coal production increased 3.1 percent during 1978. The largest increase was in the People's Republic of China where total coal production increased 11 percent. Eastern Europe and the U.S.S.R. accounted for 39.8 percent of the total world coal production in 1978.

Coal Supply and Disposition



From 1949 through 1959, domestic coal consumption declined 98 million short tons, and coal production declined only 48 million short tons. This difference was accompanied by large increases in coal stockpiled at electric utilities. From 1959 through 1969, coal consumption increased at an average annual rate of 2.7 percent. During this period, coal produced from underground mines increased 56 million short tons while production from surface mines increased nearly 82 million short tons. Coal consumption increased at an average annual rate of 2.5 percent between 1969 and 1979. From 1970 through 1979, coal production from surface mines increased 202 million short tons, whereas production at underground mines declined 39 million short tons.

Coal Export Limits for Major Coal
Exporting Countries, Historical and Projected
(million metric tons per year)

	Metallurgical Coal				Steam Coal			
	1976 Actual	1985	1990	1995	1976 Actual	1985	1990	1995
United States	43	47- 52	51- 63	56- 73	10	20- 35	22- 45	24- 49
Australia	32	50- 61	72- 87	94-131	3	10- 17	15- 27	19- 37
Canada	11	13- 27	22- 32	27- 37	1	5- 14	9- 27	14- 41
Poland a/	11	9- 12	5- 7	5- 7	30	14- 35	18- 43	23- 48
India and South Africa	2	4- 9	5- 16	7- 27	6	15- 32	15- 39	15- 46
Total	99	123-161	155-205	189-275	50	64-133	79-181	95-221

Source: Energy Information Administration, DOE.
"Coal Reserves and Production in Eight Major Non-U.S. Coal Producing Countries," ICF, Inc., December 1978.

a/ Excludes trade with other Centrally Planned Economy Countries.

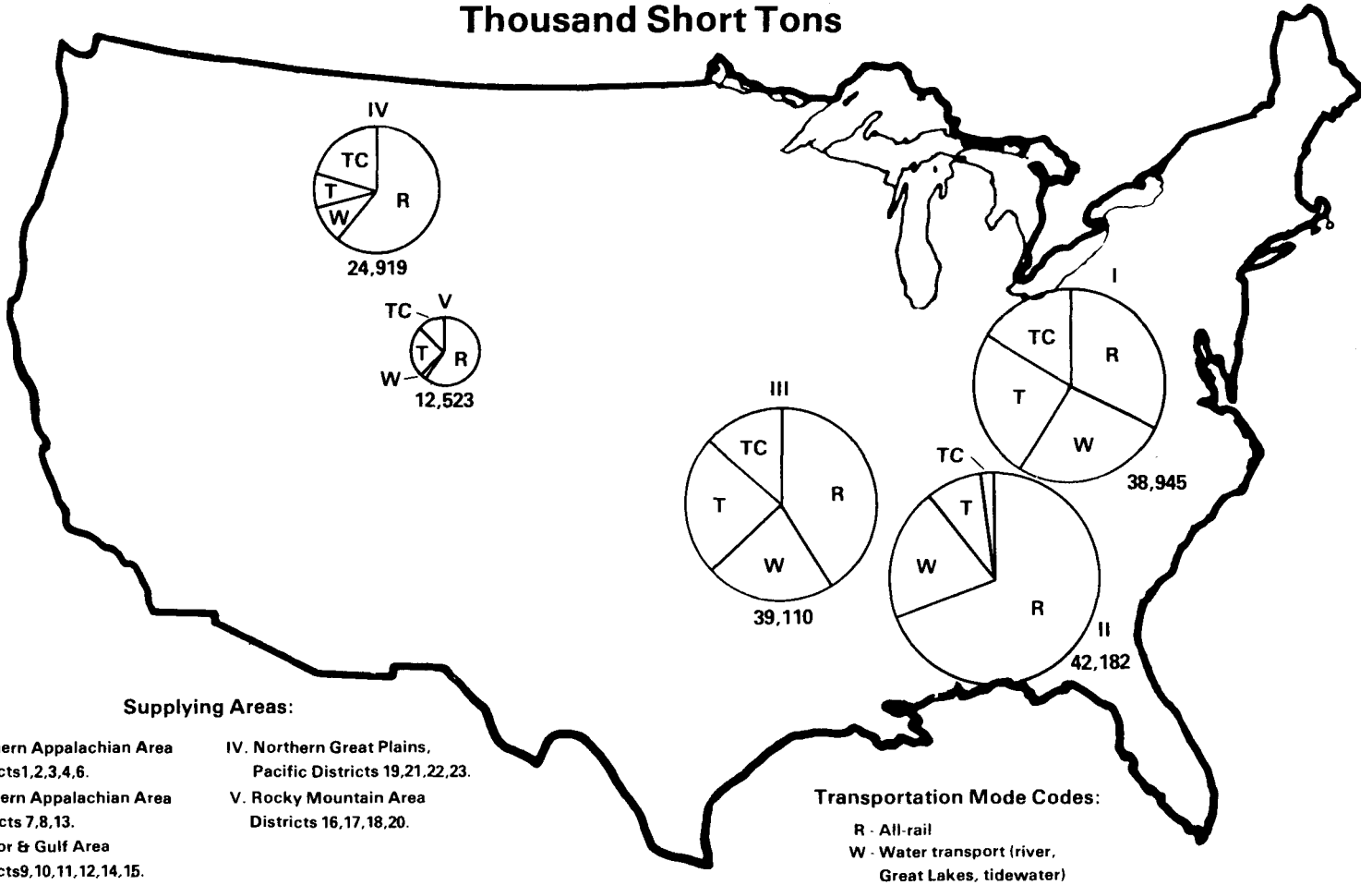
Historical and Projected Coal Exports by Major Coal Producing Countries (million metric tons)

	U.S.		Canada		Australia		South Africa and India		Poland	
	Low	High	Low	High	Low	High	Low	High	Low	High
1976										
Metallurgical	43.2		11.2		32.2 a/		.9		10.7 b/	
Steam	10.3		.6		3.2 a/		6.5		27.7 b/	
Total	53.4		11.8		35.4 a/		7.4		38.4 b/	
1985										
Metallurgical	47.0	51.7	13.6	13.9	50.0	61.2	3.6	9.0	9.0	9.0
Steam	20.1	34.5	10.6	13.6	10.9	11.9	31.8	31.8	13.6	13.6
Total	67.1	86.2	24.2	27.5	60.9	73.1	35.4	40.8	22.6	22.6
1990										
Metallurgical	51.4	62.6	22.5	25.1	72.1	86.7	12.6	15.6	5.0	5.0
Steam	22.0	44.5	9.0	21.9	14.6	14.6	39.1	39.1	18.1	18.1
Total	73.4	107.1	31.5	47.0	86.7	101.3	51.7	54.7	23.1	23.1
1995										
Metallurgical	56.5	72.9	27.1	36.5	94.3	131.1	25.1	27.1	5.0	5.0
Steam	24.2	48.6	13.6	40.7	19.2	19.2	46.4	46.4	22.7	22.7
Total	80.7	121.5	40.7	77.2	113.5	150.3	71.5	73.5	27.7	27.7

Source: Energy Information Administration, DOE.
"Steam Coal, Prospects to 2000," International Energy Agency, OECD.
"Coal Reserves and Production in Eight Major Non-U.S. Coal Producing Countries," ICF, Inc., December 1978.

a/ 1976-1977 data.
b/ 1975 data.

Shipments of Coal for United States Consumption by Producing Area and Transportation Mode[1/]
January-March 1979
Thousand Short Tons



Supplying Areas:

I. Northern Appalachian Area Districts 1,2,3,4,6.
II. Southern Appalachian Area Districts 7,8,13.
III. Interior & Gulf Area Districts 9,10,11,12,14,15.
IV. Northern Great Plains, Pacific Districts 19,21,22,23.
V. Rocky Mountain Area Districts 16,17,18,20.

Transportation Mode Codes:

R - All-rail
W - Water transport (river, Great Lakes, tidewater)
T - Truck
TC - Tramway, Conveyor and private railroad

1/Excludes railroad fuel, Great Lakes vessel fuel, Great Lakes commercial docks (consumer use not available), coal used at mines and sales to employees, and destinations and consumer uses not revealable.

Source of Data: Form EIA 6