

AP42 Section 1.2
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Reference 1

ANTHRACITE COAL
COMBUSTION
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1

Coal-Pennsylvania Anthracite

By Dorothy R. Federoff¹

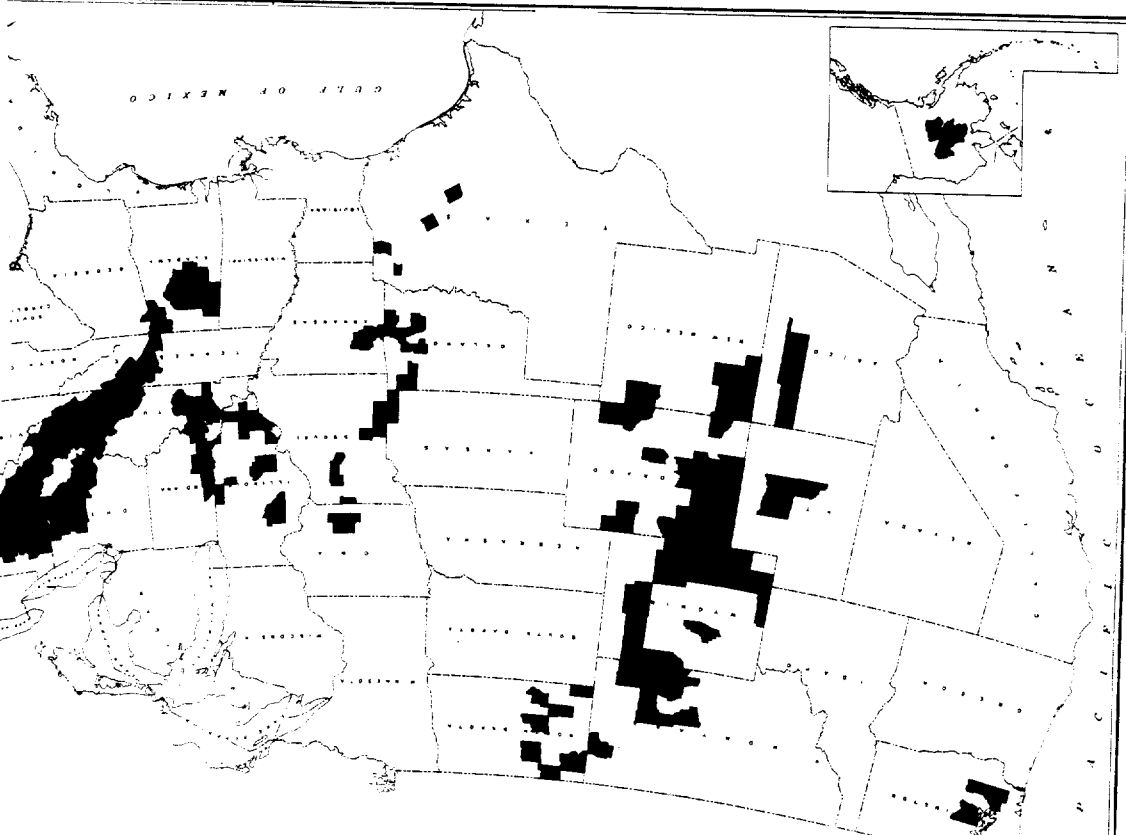


Figure 8.—Coal producing counties in the U.S. in 1975.

All of the reported production of anthracite in 1975 was in northeastern Pennsylvania. The anthracite region is divided geologically into four fields: Eastern Middle, Northern, Southern, and Western Middle. The area is also grouped into three trade regions: Lehigh, Schuylkill, and Wyoming.

The total production in 1975 was 6.2 million short tons, a decrease of 6.3% from that of 1974. The decrease was the result of a miners' strike in April during negotiation of a new wage agreement and the loss of productivity per man-day. Of the total output, 47% was recovered from culm and silt banks, 42% was produced at strip pits, 10% was from underground mines, and approximately 1% was recovered from dredging operations. Compared with tonnages produced in 1974, culm recovery declined 0.6%; strip production, 10.6%; underground production, 2.4%; and the recovery of river coal, 49.3%.

Total value of the 1975 output was \$198.5 million, a 37% increase over that of 1974. The average commercial value, f.o.b. preparation plants for all sizes, including dredge coal, was \$31.99 per ton, compared with \$21.87 per ton in 1974. The average value of pea and larger sizes increased \$14.63 per ton (from \$30.41 to \$45.04), and the average value of buckwheat No. 1 and smaller sizes increased \$8.78 per ton (from \$18.53 to \$27.31).

Apparent consumption of Pennsylvania anthracite in the United States in 1975, calculated as production minus exports (including that exported to West Germany for use by the U.S. Armed Forces), totaled approximately 5.1 million tons, compared with 5.4 million tons in 1974—a decrease

of 6%. Overall consumption was as follows: Space heating, 41.7%; electric utilities, 29.0%; coke making, 6.4%; sintering and pelletizing, 4.6%; colliery fuel, 0.2%; and other industrial uses, 18.1%.

According to the U.S. Bureau of Census, exports of anthracite for 1975 totaled 639,601 tons, with a net value of \$25.8 million. A 13% decrease in shipments was indicated, compared with 1974 exports. A more complete measurement of exports can be obtained by adding the quantity shipped for use by the U.S. Armed Forces in West Germany to the tonnage reported by the Bureau of Census. This computation indicates that 1,095,293 tons of anthracite was actually exported in 1975, a decrease of 6% from 1974 exports.

The Pennsylvania anthracite-mining industry worked an average of 214 days in 1975 and employed a work force of 3,907. Of that total, 733 were employed at underground mines, 1,468 at strip operations, 400 in the recovery of culm and silt banks, 15 in the dredging operations, and 1,291 at preparation plants and other surface operations. In operation were 109 underground mines, 100 strip pits, 133 culm and silt banks, 8 dredges, and 91 preparation plants.

Although the work force increased 1.6% in 1975, the decline in production was attributable to the strike during April and the loss of productivity per man-day. The productivity rate in average tons per man-day decreased from 7.87 in 1974 to 7.45 in 1975. One fatality occurred in 1975 (two in 1974), and nonfatal injuries increased from 262 in 1974 to 351 in 1975.

The Bureau of Mines publishes a series of weekly and monthly reports containing estimates of production derived primarily

¹ Mineral specialist, Division of Fuels Data.

Note: This is a reference cited in AP 42, *Compilation of Air Pollutant Emission Factors, Volume I Stationary Point and Area Sources*. AP42 is located on the EPA web site at www.epa.gov/ttn/chief/ap42/

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control program, a comprehensive mine-pool monitoring stations have been installed, and additional phases of the project are proceeding in the Wyoming, Middle, and Southern fields.

A program continued for mined-land demonstration activities mainly directed toward public health and safety problems associated with mine subsidence. Progress included the adaptation of pressure flushing to larger sized mine refuse materials and efforts to monitor the effectiveness of mine sealing and flushing. Efforts included investigations into the causes and environmental effects of mine subsidence, attempts at early detection, an inventory of cases of subsidence, and development of more economic techniques for controlling and preventing mine subsidence.

The value of the longstanding map-folio program to the public was demonstrated by the numerous requests received by the Bureau of Mines from Federal and local authorities. The requests were for aid in evaluating subsurface conditions to determine mine subsidence potential for proposed civic improvements and as a cause of possible structural failure in bridges and highways. Work continued on compiling surface and bed maps in stratigraphic sequence for selected areas.

Table 1.—Salient statistics of the Pennsylvania anthracite industry

	1971	1972	1973	1974	1975
Production:					
Preparation plants ————— short tons —	8,323,168	6,618,205	6,377,512	6,454,385	6,117,156
Dredges ————— do —————	389,609	476,792	441,076	150,468	76,142
Use at collieries for power and heat ————— do —————	14,548	11,298	11,373	12,013	10,012
Total production ————— do —————	8,727,325	7,106,295	6,829,961	6,616,866	6,203,310
Value ————— thousands —	\$103,469	\$85,251	\$90,266	\$144,695	\$198,481
Average sales realization per short ton on preparation-plant shipments (excludes dredge coal):					
Pea and larger —————	\$16.39	\$17.18	\$18.76	\$30.41	\$45.04
Buckwheat No. 1 and smaller —————	\$9.90	\$10.14	\$11.30	\$18.88	\$27.61
All sizes —————	\$12.08	\$12.40	\$13.65	\$22.19	\$32.26
Percentage of total preparation-plant shipments (excludes dredge coal):					
Pea and larger —————	33.6	32.0	31.4	28.8	26.7
Buckwheat No. 1 and smaller —————	66.4	68.0	68.6	71.2	73.3
Exports ¹ ————— short tons —	671,024	743,451	716,546	735,173	639,601
Consumption, apparent ² ————— do —	7,338,000	5,915,000	6,671,000	5,448,000	5,108,000
Average number of days worked —————	239	216	234	219	211
Output per man per day ————— short tons —	5,800	4,783	4,083	3,847	3,907
Output per man per year ————— do —	6,300	6,888	7,115	7,877	7,435
Quantity cut by machines ————— do —	1,505	1,486	1,673	1,720	1,694
Quantity mined by stripping ————— do —	6,018	3,483,976	3,278,977	2,868,783	2,563,701
Quantity loaded by machines ————— do —	4,478,350	3,483,976	3,278,977	2,868,783	2,563,701
underground ————— do —					
Distribution:					
Exports to Canada ¹ ————— do —	669,691	593,997	421,202	307,475	298,944
Loaded into vessels at ————— do —	466,039	500,306	477,692	481,845	543,562
Lake Erie ³ ————— do —	51,402	39,177	19,244	22,965	12,476

¹ U.S. Department of Commerce, 1971-75 export data does not include shipments to U.S. military forces.

² Excludes shipments to U.S. Armed Forces.

³ Ore and Coal Exchange, Cleveland, Ohio.

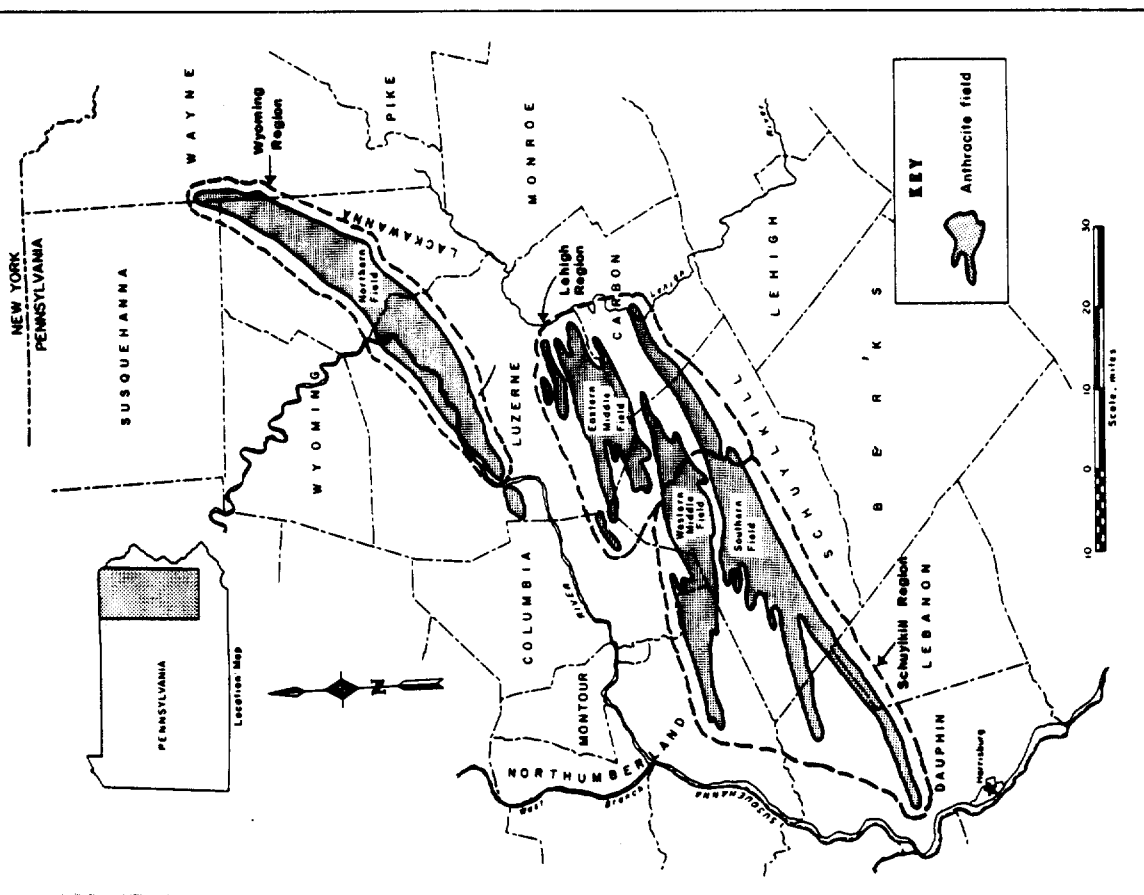


Figure 1.—Coalfields, regions, and counties of the Pennsylvania anthracite area.

DOMESTIC PRODUCTION

Underground production continued to decline because of the health and safety regulations, manpower shortage, and the high cost of pumping water from flooded mines. The output from underground mines in 1975 totaled approximately 641,000 tons, a decrease of 2.4% from that of 1974. The Schuylkill region accounted for 99.1% of the output, and the Wyoming region for the remainder.

Production from strip operations totaled about 2.6 million tons, a decrease of 10.6%. In the Schuylkill region, strip mine production totaled 1.3 million tons, a decrease of 10.0%; in the Lehigh region, 1.1 million tons, a decrease of 11.6%; and in the Wyoming region, 189,000 tons, a decrease of 9.1% from that of 1974.

Culm and silt recovery remained at almost the same level—2,922,000 tons in 1975 (2,940,000 tons in 1974). Of the total, 720,000 tons was recovered in the Lehigh region, an increase of 53.8% over that in 1974, and 710,000 tons was recovered in the Wyoming region, an increase of 63.2%. However, the 1,492,000 tons recovered in the Schuylkill region showed a decline of 26.8% from that of 1974.

Dredging operations produced approximately 76,000 tons in 1975, compared with 150,000 tons in 1974—a drop of 49.3%. Several operations were discontinued because insufficient coal remained in the riverbed to make the salvage operations economically feasible.

Total production in the Lehigh region for 1975 was 6.8% greater than in 1974. A decrease of 11.6% in strip mine production was offset by a 53.8% increase in the recovery of anthracite from culm banks. The Schuylkill region had a decrease in production of 17.6% from that in 1974. Although underground production increased 1.9%, all of the other categories

ness activities. The process continued into the third quarter, resulting in lower steel-product shipments in 1975, compared with those in the same period in 1974. Overall consumption was as follows: Space heating, 41.7%; electric utilities, 29.0%; coke making, 6.4%; sintering and pelletizing, 4.6%; other industrial uses, 18.1%; and colliery fuel, 0.2%. Although consumption for "other industrial uses" increased 68.2% over that of 1974, declines were indicated in the electric utilities, 1.1%; coke making, 26.6%; sintering and pelletizing, 35.4%; and colliery fuel, 16.7%.

STOCKS

Monthly data on stocks held at retail yards indicated an inventory of 4,000 tons at yearend 1975, a decrease of 35.2% from that of yearend 1974.

Electric utilities reported an increase of 6% in their inventories—982,000 tons at yearend 1975 compared with 930,000 tons at the end of 1974.

Stocks at coke plants totaled 126,000 tons at yearend 1975, a decrease of 26.7% from the 172,000 tons at yearend 1974.

Stocks at Upper Lake Docks (Lake Superior and Lake Michigan) were less than 500 tons at yearend 1975, relatively comparable to those at yearend 1974.

PRICES AND SPECIFICATIONS

Based on total production, including colliery fuel and dredge coal, the average value per ton for 1975 was \$31.99 f.o.b. preparation plant, compared with \$21.87 per ton in 1974, an increase of 46.3%. The average value per ton of the larger size groups in 1975 was \$45.04 f.o.b. preparation plant, an increase of \$14.63 from that in 1974. The prices for individual sizes (excluding dredge coal) were as follows: Egg, \$45.82 (an increase of \$12.91); stove, \$46.59 (an increase of \$15.05); chestnut, \$45.34 (an increase of \$14.28); and pea, \$42.33 (an increase of \$14.72).

The average value of the smaller size groups was \$27.61 per ton f.o.b. preparation plant, compared with \$18.88 per ton

in 1974, an increase of \$8.73. The individual prices for the smaller sizes were buckwheat No. 1, \$43.50 (an increase of \$15.14); buckwheat No. 2 (rice), \$39.86 (an increase of \$13.13); buckwheat No. 3 (barley), \$37.43 (an increase of \$14.27); buckwheat No. 4, \$33.80 (an increase of \$14.45); buckwheat No. 5, \$25.74 (an increase of \$6.92); and the "other" category, \$12.29 (an increase of \$3.52).

The Black Diamond magazine quoted wholesale prices f.o.b. preparation plants in 1975 as follows: Egg, stove, and chestnut, \$42.50 to \$47.50; pea, buckwheat No. 1, and buckwheat No. 2 (rice), \$37.50 to \$42.50; and buckwheat No. 3 (barley), \$35.50 to \$42.50.

FOREIGN TRADE

According to the data released by the U.S. Bureau of Census, 639,601 short tons of Pennsylvania anthracite was exported in 1975, a decrease of 13% from that shipped in 1974. Of the total, 85% was exported to Canada (an increase of 12.9% over that shipped in 1974), 1.3% to South America, 0.5% to Asia, and the remainder to other countries. The Census Bureau

figures do not include anthracite shipped abroad for the use of U.S. Armed Forces in West Germany; therefore, a more complete measurement of exports can be obtained by adding the military tonnage (455,692 tons) to the tonnage reported by the Bureau of Census. Consequently 1,095,293 tons of anthracite was exported in 1975.

DISTRIBUTION

Reports submitted to the Bureau of Mines by producers, wholesalers, and exporting firms indicated that 5,946,229 short tons of Pennsylvania anthracite was shipped during the 1975 calendar year—a decrease of 4.7% from that of 1974. Where possible, coal used largely for generating electricity and for colliery fuel was eliminated from the statistics. Of the total shipped to market during the year, 81.6% was shipped to points in the United States (a decrease of 4.3% from that in 1974); exports to the Canadian market totaled 543,552 tons, or 9.1% of the total (an increase of 12.9% over 1974 shipments); and exports to countries other than Canada totaled 551,741 tons (a decrease of 19.8% from those in 1974).

In the U.S. market, shipments of pea and larger sizes continued to decline (24.3% in 1975; 12.7% in 1974). In contrast, the demand for industrial size continued to increase—3.1% in 1975 compared with 2.3% in 1974. The pea and larger sizes comprised 21.3% of the total distributed (26.9% in 1974), and buckwheat No. 1 and smaller sizes comprised 78.7% of the total (73.1% in 1974). Shipments in the Middle Atlantic States increased 1.1% over those in 1974, but other shipments declined: Those to the New England States, 26.4%; to the South Atlantic States, 48.1%; to the Lake States, 28.0%; and to Other States, 21.6%.

Of the total anthracite distributed, 3,802,641 tons was shipped by truck and the remainder by rail. Additional details of anthracite distribution for 1975 are presented in a Bureau of Mines report.²

² U.S. Bureau of Mines, Distribution of Pennsylvania Anthracite for the Calendar Year, 1975. Mineral Industry Survey, Oct. 15, 1975, 8 pp.

Complete data on output are not available from all anthracite-producing countries. Some data are only estimates, while other data include coals that, by U.S. standards, are of no higher quality than semianthracite. Despite these inadequacies, the information is sufficiently accurate to indicate general trends. Based on such information, and in full recognition of the margin of error that could exist, it is indicated that total world production in 1975 was 195.2 million tons, an increase of 0.8% over the 193.7 million tons produced in 1974.

The combined output of the U.S.S.R., North Korea, the People's Republic of China, and the Republic of Korea totaled 160.4 million tons, or 82.2% of total world production. Countries registering increases in the production of anthracite include the Republic of Korea, 15.3%; Morocco, 13.6%; North Vietnam, 12.8%; the Republic of South Africa, 10.9%; Spain, 4.4%; North Korea, 2.9%; and the U.S.S.R., 0.4%.

China, People's Republic of.—Coal deposits are known to exist in widespread areas of China, ranging in quality from brown coal through all types of bituminous coal to anthracite. The biggest anthracite producer is Yangchuan, comprising 12 pairs of mine shafts, or 4 to 6 mines, in Shansi Province. Yangchuan increased its production in 1975. The other major anthracite-producing district is Mentokou. These two major districts combine with other smaller districts to produce 22 million tons of anthracite annually.

Japan.—Production of anthracite in 1975 totaled 101,000 tons, compared with 154,000 tons in 1974—a decrease of 34.4%. Imports totaled 1,131,000 tons, a decline of 32.4% from that of 1974. The principal sources were North Vietnam, 555,183 tons (a decrease of 24.2%); the People's Republic of China, 367,284 tons (a decrease of 9.2%); and Canada, 112,440 tons (a decrease of 24.1%). The total comprised 91.5% of the anthracite imported in 1975. The remainder was imported from North Korea, the Republic of South Korea, the Republic of South Africa, the U.S.S.R., and the United States.

Korea, North.—Output of anthracite totaled 35.0 million tons in 1975, a 2.9% increase over the 34.0 million tons in 1974. Geological prospecting teams re-

portedly have discovered coal deposits that will play a big role in attaining the 10 million-ton coal-output target. Fairly large deposits are located in the Incheon and Ipsok districts. Prior to the recent discovery, coal deposits estimated at tens of millions of tons were discovered in the Tokchon district, south Pyongyang Province. A coalfield is being developed in the Namyang district in the same Province. Anthracite deposits estimated at 8 billion tons are primarily in the vicinity of Pyongyang. Mass movement of coal has an important role in North Korea's rapidly expanding coal industry; consequently, pipes, cableways, and belt conveyors are being introduced in various areas of the coal regions. The latest coal mining project to be completed is the 10-mile cableway.

Mexico.—Virtually all coal reserves lie in the areas of Barrancas, Oaxaca, and Coahuila. Barrancas contains an estimated 22 million tons of coal, predominantly anthracite. The largest consumer of solid fuels in Mexico is the steel industry. As indigenous coal production increases, imports will in all probability decline. Imports of anthracite from the United States in 1975 totaled 12,128 tons, compared with 10,317 tons imported in 1974—an increase of 17.6%.

Morocco.—Production of anthracite in 1975 totaled 719,000 tons, an increase of 13.6% over that of 1974. Despite local unemployment in the past, it has been difficult to recruit labor owing to poor working conditions and wages. At present, mechanization plans are underway that should ultimately help improve these conditions. Although the expansion program is primarily to satisfy domestic requirements, demand for coal is expected to decline in favor of oil. It is therefore possible that limited quantities of anthracite could be made available for export.

Peru.—A survey conducted by Kopex of Poland indicated that coal deposits at Alto Chicama (La Libertad) contain 270 million tons of anthracite, of which 59 million tons are proven reserves. The survey is part of a feasibility study for the development of the reserves and the construction of a 240-megawatt power station at Alto Chicama. Peru produced an estimated 11,000 tons of anthracite in 1975.

South Africa, Republic of.—Output of an-

thracite in 1975 totaled 1.8 million tons, an increase of 10.9% over that in 1974. The discovery of what is believed to be one of the richest coal deposits in Africa in the Nongoma district of Kwazulu, South Africa, has been announced by Ubonbo Mines. Investigations reportedly show that reserves of anthracite will be greater than those of the rest of South Africa combined and could prove to be in excess of 100 million tons.

South Korea, Republic of.—The production of anthracite in 1975 totaled 19.3 million tons, compared with 16.9 million tons in 1974—an increase of 15.3%. South Korea's efforts to exploit indigenous coal reserves to the maximum extent to assure a stable supply of low-cost fuel for household needs will be assisted by the Asian Development Bank. The bank loan is for the foreign exchange component of the Coal Development Project, which consists of the rehabilitation and expansion of coal-production facilities at Dai Han Coal Corp. (DHCC), a wholly Government-owned corporation. The money will be used for overseas purchases of mining equipment, plant, and safety equipment and to cover the services of foreign consultants who will assist in the implementation of the project. The project is expected to be completed by the end of 1978; its aim is to increase DHCC's annual coal production from the current level of about 4.5 million tons to approximately 6.2 million tons in 1979. The Government plans to reduce the country's dependence on imported oil and maximize the development of coal and water power resources, as well as its utilization of atomic energy. The aim is to have coal products account for 34.1% of the total energy supply by the year 1980, an increase of 3.4% over the previous target. Proven coal reserves (predominately anthracite) are currently estimated to be in the range of 546 million tons. At present projected mining rates, the proven reserves are adequate to support coal production for 23 years.

Spain.—Although Spain produced 3.4

TECHNOLOGY

The Energy Research and Development Administration (ERDA) is examining the combustibility characteristics of refuse

materials from anthracite mining operations and reject streams of preparation cleaning plants in a fluidized-bed combus-

tion. In 1975, over that of 1974, imports rose from 6,758 tons in 1974 to 19,660 tons in 1975. Of the total, 19,335 tons was imported from the Republic of South Africa and the remainder from the Netherlands.

United Kingdom.—Output of anthracite in 1975 totaled an estimated 2.7 million tons, a decline of 3.3% from the 1974 level. At the large Maesgwyn opencast site, Glynneath, where an estimated 1.5 million tons of anthracite remains to be recovered, an 1,800-ton dragline, with a 247-foot boom and 40-cubic-yard-capacity bucket to remove overburden, is back in operation after a 12-month overhaul. The dragline is the largest in use in South Wales and the second-largest in Britain.

U.S.S.R.—Production of anthracite in 1975 totaled 84 million tons, an increase of 0.5% over that of 1974. The output of anthracite and bituminous coal in the Donetsk Basin is to reach an estimated 231 million to 233 million tons by 1980, and the projected 1985 figure is 245 million tons. Because this region contains vast fields of anthracite and coking coal, the U.S.S.R. will insure an increased output by renovating old mines, reopening new mines, and using highly efficient machines and techniques to increase capacities for coal extraction and processing. Principal recipients of the exports of anthracite are Europe and Japan.

Vietnam, North.—Output of anthracite totaled 4.4 million tons in 1975, an increase of 12.8% over that of 1974. Total known coal reserves, predominately anthracite, are estimated at 2.5 million to 3.0 million tons. The Hon Gai mine, the largest in the country, expects to produce about 4.4 million tons annually. The burgeoning coal export trade is likely to increase the utilization of the port of Hon Gai, although most coal for export is presently handled through Cam Pha. Japan may be importing coal in quantity from Vietnam; exports to Japan in 1975 totaled 555,183 tons.

Center, Morgantown, W. Va.³

The value of this refuse as a fuel is important in the anthracite region because of the decline in mining in the area, which has led to a growing dependence on oil. The burning of this material in fluidized-bed combustors would provide fuel in a region that needs fuel.

The atmospheric-pressure fluidized-bed combustor is basically a refractory-lined cylindrical combustor of 18-inch internal diameter in the bed region, with an expanded freeboard cross section of 24-inch diameter. The combustor is equipped with a horizontal, water-cooled heat exchanger submerged in the bed and a separate water-cooled tube bundle in the freeboard to reduce gas temperature. To control temperature with the low-heating-value refuse fuels, six hairpin loops of 1/4-inch 310 stainless steel pipe with individual water-flow controls were installed. Fuel is pneumatically injected into the base of the combustor with room-temperature air. Fluidizing air is provided through a plenum that feeds a number of orifices in the conical distributor. The reject solids that are separated from the exit flue gas by the primary cyclone can be reinjected into the bed with an air injector for carbon burnup. Flue gases are further cleaned by the secondary cyclone and parallel bag filters before exiting through the stack. Gases are sampled for online analysis at the exit of the combustor. Excess spent bed material is withdrawn through the apex of the inverted conical air distributor with a screw feeder.

An operating period with the combustor typically lasts 5 days, 24 hours per day. Startup begins by preheating the empty combustor vessel with a premixed natural gas-air flame through the air distributor. When operating temperature is reached, the fluidized bed is built by feeding either

Table 2.—Standard anthracite specifications approved and adopted by the Anthracite Committee, effective July 28, 1947, and amended July 20, 1953

Size	Round test mesh (Inches)	Percent		
		Underize	Maximum impurities ¹	Ash ²
		Maxi- mum	Slate	Bone
Broken	Through 4 3/8 Over 3 1/4 to 3	15	1 1/2	2
Egg	Through 3 1/4 to 3 Over 2 7/16	15	1 1/2	2
Stove	Through 2 7/16 Over 1 5/8	15	2	3
Chestnut	Through 1 5/8 Over 13/16	15	8	4
Pea	Through 13/16 Over 9/16	15	4	6
Buckwheat No. 1	Through 9/16 Over 5/16	15	7 1/2	13
Buckwheat No. 2 (rice)	Through 5/16 Over 3/16	17	7 1/2	13
Buckwheat No. 3 (barley)	Through 3/16 Over 3/32	20	10	15
Buckwheat No. 4	Through 3/32 Over 3/64	30	10	15
Buckwheat No. 5	Through 3/64	NL	NL	16

NL No limit.

¹When slate content in sizes from broken to chestnut, inclusive, is less than above standards, bone content may be increased by 1 1/2 times the decrease in slate content under the allowable limits, but slate content specified above shall not be exceeded in any event.

²A tolerance of 1% is allowed on maximum percentage of underize and maximum percentage of ash content.

Maximum percentage of underize is applicable only to anthracite as it is produced at preparation plant.

Slate is defined as any material that has less than 40% fixed carbon.

Bone is defined as any material that has 40% or more, but less than 75%, fixed carbon.

³Ash determinations are on a dry basis.

Table 3.—Project report

Project location	Project description	Sponsor	Status of report
ACID COAL MINE DRAINAGE			
Anthracite fields	Monthly measurements of mine water levels and overflows.	U.S. Geological Survey and U.S. Bureau of Mines.	Continuous.
Columbia, Northumberland, Schuylkill Counties.	Mine Drainage Project No. 46, Phase D, construction of mine water pool monitoring stations.	U.S. Bureau of Mines and Commonwealth of Pennsylvania.	Work completed in 1975.
Carbon, Dauphin, Schuylkill Counties, Rausch Creek.	Mine Drainage Project No. 46, Phase E, General construction of treatment plant.	Commonwealth of Pennsylvania.	Work started in 1976. Work completed in 1976.
Lackawanna County, Lackawanna River and Mayfield Honey Run.	Restoration	do	Do.
SURFACE SUBSIDENCE			
Lackawanna County; Carbondale West	Appalachian subsidence control, project No. 8.	Commonwealth of Pennsylvania and U.S. Bureau of Mines.	Work completed in 1976.
Dickson City	Subsidence control, backfilling	U.S. Bureau of Mines.	Work started in 1976.
Olyphant Borough	Demonstration project for hydraulic backfilling into inaccessible mine voids to establish limitations in the use of the pumped slurry.	do	Work in progress in 1976.

Table 3.—Project report—Continued

Project location	Project description	Sponsor	Status of report
SURFACE SUBSIDENCE—Continued			
Lakawanna County— Continued			
Scranton: Green Ridge section.	Demonstration project for filling mine voids under approximately 35 acres.	U.S. Bureau of Mines	Work started in 1972; completed in 1976.
Hill section	Filling abandoned mine voids	U.S. Bureau of Mines and Commonwealth of Pennsylvania.	Work in progress in 1976.
Minooka section.	Filling mine voids. Blind-flushing approximately 17 acres of a pilot demonstration project.	do	Work completed in 1976.
Southside section.	Hydraulic flushing of mine voids, project No. 11.	do	Work in progress in 1976.
Luzerne County: Pittston	Subsidence control	do	Work started in 1976.
UNDERGROUND MINE FIRES			
Lakawanna County: Eddy Creek, Boroughs of Throop and Olyphant.	Mine fire control using a pumped slurry backfilling method of burned breaker refuse.	U.S. Bureau of Mines.	Work completed in 1976.
Columbia County: Centralia Borough	Appalachian mine fire control, including exploratory drilling and underground barrier pillars formed by injecting fly ash into mine voids.	U.S. Bureau of Mines and Commonwealth of Pennsylvania.	Work continues in 1976.
SURFACE MINE RECLAMATION PROJECTS			
Lakawanna County: Scranton: Cedar Avenue	Revegetation project of barren mine lands, research demonstration.	U.S. Bureau of Mines and Commonwealth of Pennsylvania.	Work completed in 1976.
Taylor Borough	Keyser Valley strip mine area reclamation, demonstration project.	do	do
Luzerne County: Preston	Refuse-bank reclamation demonstration project on the feasibility of using anthracite fly ash with lime, grass seeds, and legumes to vegetate the surface. Project is under the direction of the Energy Research and Development Administration at Morgantown, W. Va.	do	do

Table 4.—Summary of monthly developments in the Pennsylvania anthracite industry in 1975
(Thousand short tons, except as otherwise indicated)

Change from 1974	Total 1974	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total 1975	(Per cent)
6,617	8,019	198	198	186	66	201	190	187	208	190	169	168	129	2,073	-81.3
89	8,917	814	868	284	198	248	288	8	8	8	818	222	624	8,600	-8.1
28	2	8	3	3	1	3	3	3	3	3	3	2	2	18.0	-18.0
2	2	---	---	---	---	2	2	---	3	2	3	---	---	47.8	-47.8
2	2	(^e)	(^e)	(^e)	(^e)	(^e)	(^e)	(^e)	(^e)	(^e)	(^e)	(^e)	(^e)	60.0	-60.0
2	2	89	44	32	68	16	66	89	46	102	56	21	68	640	-12.9
1,498	1,498	138	121	110	116	144	129	119	180	119	120	120	117	1,482	-1.1
980	980	920	916	946	987	968	962	986	1,008	1,006	1,080	1,080	982	982	+5.6
444	444	30	29	33	27	26	22	26	26	26	29	27	328	328	-26.1
172	172	171	165	169	146	186	181	126	126	126	126	126	126	126	-26.7
(^e)	(^e)	(^e)	(^e)	(^e)	(^e)	(^e)	(^e)	(^e)	(^e)	(^e)	(^e)	(^e)	(^e)	(^e)	---
68	68	61	62	72	74	68	62	47	37	84	86	81	47	80.9	-80.9
16	16	7	16	16	14	14	15	18	18	12	11	11	11	81.8	-81.8
91	91	84	81	91	90	79	69	62	52	49	48	44	59	59	-56.2
321	321	12	12	18	18	9	7	12	14	16	14	8	11	146	-54.5
890	890	46	40	61	61	24	11	13	15	18	14	47	66	29.7	+29.7
824	824	51	49	62	62	54	51	39	51	66	46	47	66	94.4	+94.4
1,080	1,080	109	101	186	186	96	71	83	64	80	96	78	63	1,050	+1.5
229.2	229.2	319.0	319.0	319.0	319.0	319.0	319.0	319.0	319.0	319.0	319.0	319.0	319.0	319.0	+50.4
270.3	270.3	378.9	378.9	378.9	378.9	427.6	427.6	427.6	427.6	427.6	427.6	427.6	427.6	427.6	+52.6
270.3	270.3	378.9	378.9	378.9	378.9	427.6	427.6	427.6	427.6	427.6	427.6	427.6	427.6	427.6	+52.6

See footnotes on next page.

¹ Furnished by initial carriers.
² Pennsylvania Department of Mines and Mineral Industries.
³ Association of American Railroads.
⁴ Ore and Coal Exchange, Cleveland, Ohio.
⁵ Data furnished by Lake dock operators.
⁶ Less than 1/2 unit.
⁷ U.S. Department of Commerce. Does not include shipments to the U.S. military forces.
⁸ Federal Power Commission.
⁹ Estimated from reports submitted by a selected list of retail dealers located outside the producing region.
¹⁰ Furnished by the Bureau of Labor Statistics from data obtained from authorized trade publications.
NOTE.—According to the Association of American Railroads, 582,185 short tons of anthracite were exported to Europe during 1975, compared with 589,174 short tons for 1974. Of this total 510,577 short tons were consigned to West Germany and the Netherlands including exports to the U.S. military forces. This compares with 412,611 short tons for 1974.

Table 5.—Commercial production of Pennsylvania anthracite in 1975, by region and size

	From preparation plants												From river dredging			Total ³		
	Lehigh region			Schuylkill region			Wyoming region ¹			Total preparation plants ²			Rail	Truck	Total ²	Rail	Truck	Total
	Rail	Truck	Total ²	Rail	Truck	Total ²	Rail	Truck	Total ²	Rail	Truck	Total						
Quantity, thousand short tons:																		
Lump and broken																		
Egg	99	2	101	1	(8)	2	13	1	14	114	4	117				114	4	117
Stove	187	31	218	176	115	291	20	7	27	384	153	537				384	153	537
Chestnut	101	100	202	143	189	331	13	29	41	257	318	575				257	318	575
Pea	26	87	112	73	170	242	3	46	49	101	302	404				101	302	404
Total pea and larger ²	413	220	633	893	474	867	50	83	133	856	777	1,633				856	777	1,633
Buckwheat No. 1	92	90	183	105	199	303	11	82	93	208	371	579				208	371	579
Buckwheat No. 2 (rice)	21	132	153	46	239	284	3	83	86	70	453	523				70	453	523
Buckwheat No. 3 (barley)	57	104	161	148	257	404	6	114	119	210	475	685				210	475	685
Buckwheat No. 4	51	35	86	137	126	263	4	61	65	191	223	414				191	223	414
Buckwheat No. 5	135	54	189	247	283	531	13	19	32	396	356	752				396	356	752
Other ⁴	14	354	368	25	762	787	21	356	377	61	1,472	1,533	1	75	76	62	1,547	1,609
Total buckwheat No. 1 and smaller ²	371	769	1,140	708	1,865	2,573	57	714	772	1,136	3,349	4,485	1	75	76	1,137	3,425	4,562
Grand total ²	784	989	1,773	1,100	2,339	3,439	107	797	905	1,991	4,126	6,117	1	75	76	1,992	4,201	6,193
Value, thousands:																		
Lump and broken	4,519	88	4,607	77	11	88	610	60	670	5,206	159	5,366				5,206	159	5,366
Egg	8,672	1,453	10,124	8,330	5,273	13,603	956	333	1,288	17,958	7,058	25,015				17,958	7,058	25,015
Stove	4,526	4,536	9,062	6,649	8,466	15,115	585	1,294	1,879	11,760	14,296	26,056				11,760	14,296	26,056
Chestnut	1,050	3,588	4,638	3,336	7,094	10,430	127	1,895	2,022	4,513	12,577	17,090				4,513	12,577	17,090
Pea																		
Total pea and larger ²	18,767	9,665	28,431	18,393	20,844	39,237	2,277	3,582	5,859	39,437	34,090	73,527				39,437	34,090	73,527
Buckwheat No. 1	4,003	3,947	7,950	5,077	8,307	13,384	472	3,374	3,847	9,553	15,628	25,181				9,553	15,628	25,181
Buckwheat No. 2 (rice)	855	5,221	6,076	1,982	9,406	11,387	111	3,267	3,378	2,948	17,893	20,841				2,948	17,893	20,841
Buckwheat No. 3 (barley)	2,336	3,846	6,181	6,154	9,588	15,742	240	3,470	3,710	8,730	16,903	25,633				8,730	16,903	25,633
Buckwheat No. 4	1,912	1,194	3,106	5,665	3,420	9,085	124	1,668	1,792	7,701	6,282	13,984				7,701	6,282	13,984
Buckwheat No. 5	4,393	1,587	5,980	6,844	5,645	12,489	446	431	877	11,683	7,663	19,346	10	751	761	1,237	18,352	19,588
Other ⁴	270	4,246	4,516	529	8,854	9,383	428	4,500	4,929	1,227	17,601	18,827						
Total buckwheat No. 1 and smaller ²	13,769	20,041	33,810	26,250	45,220	71,470	1,822	16,710	18,532	41,841	81,971	123,812	10	751	761	41,852	82,722	124,573
Grand total ²	32,536	29,706	62,241	44,643	66,064	110,707	4,099	20,292	24,391	81,278	116,061	197,339	10	751	761	81,288	116,812	198,101
Average value per ton: ⁵																		
Lump and broken	45.70	45.28	45.70	54.44	47.94	58.56	45.87	45.00	45.79	45.83	45.34	45.82				45.83	45.34	45.82
Egg	46.35	46.45	46.37	47.32	45.72	46.69	46.73	48.93	47.28	46.82	46.01	46.59				46.82	46.01	46.59
Stove	44.60	45.25	44.92	46.60	44.84	45.60	45.56	45.15	45.28	45.76	45.00	45.34				45.76	45.00	45.34
Chestnut	40.84	41.41	41.28	45.95	41.84	43.07	40.98	41.05	41.04	44.50	41.60	42.33				44.50	41.60	42.33
Pea																		
Total pea and larger	45.42	43.91	44.90	46.83	43.98	45.27	45.84	43.17	44.17	46.09	43.88	45.04				46.09	43.88	45.04
Buckwheat No. 1	43.47	43.63	43.55	48.50	41.82	44.13	43.87	41.03	41.36	46.03	42.08	43.50				46.03	42.08	43.50
Buckwheat No. 2 (rice)	39.95	39.63	39.67	43.52	39.42	40.08	40.16	39.43	39.46	42.29	39.48	39.86				42.29	39.48	39.86
Buckwheat No. 3 (barley)	40.91	36.89	38.31	41.68	37.36	38.94	42.55	30.53	31.10	41.49	35.62	37.43				41.49	35.62	37.43
Buckwheat No. 4	37.71	34.10	36.23	41.43	27.11	34.56	33.77	27.16	27.53	40.30	28.23	33.80				40.30	28.23	33.80
Buckwheat No. 5	32.51	29.29	31.59	27.65	19.95	23.54	33.71	23.11	27.51	29.51	21.54	25.74	10.00	10.00	10.00	29.51	21.54	25.74
Other ⁴	19.09	12.00	12.27	20.73	11.62	11.92	20.00	12.65	13.07	20.10	11.96	12.29				19.93	12.18	12.18
Total buckwheat No. 1 and smaller	37.16	26.04	29.66	37.10	24.25	27.78	31.69	23.39	24.01	36.84	24.48	27.61	10.00	10.00	10.00	36.82	24.16	27.31
Grand total	41.52	30.02	35.10	40.57	28.25	32.19	38.25	25.45	26.96	40.82	28.13	32.26	10.00	10.00	10.00	40.80	27.81	31.99

¹ Includes Sullivan County.
² Data may not add to totals shown because of independent rounding.
³ Less than 1,000 short tons.
⁴ Includes various mixtures of buckwheat Nos. 2 to 5 and coal of relatively low dollar value.
⁵ Average value derived from actual rather than rounded data.

Table 7.—Production of Pennsylvania anthracite in 1973, by region and county
(Thousand short tons and thousand dollars)

Source	Rail shipments		Truck shipments		Colliery fuel		Total production ¹	
	Quan- tity	Value ²	Quan- tity	Value ²	Quan- tity	Value	Quan- tity	Value ²
REGION								
Lehigh: Preparation plants	784	32,536	990	29,705	4	167	1,778	62,408
Schuylkill: Preparation plants	1,100	44,643	2,339	66,064	5	202	3,445	110,909
Dredges	1	10	75	751	--	--	76	761
Total Schuylkill	1,101	44,653	2,414	66,815	5	202	3,521	111,670
Wyoming: Preparation plants ³	107	4,099	797	20,292	(*)	11	905	24,402
Total ^{1,2}	1,991	81,278	4,126	116,061	10	380	6,127	197,719
Dredges	1	10	75	751	--	--	76	761
Grand total ¹	1,992	81,288	4,201	116,812	10	380	6,203	198,481
COUNTY								
Berks and Snyder	1	10	50	502	--	--	51	512
Carbon	60	2,494	899	5,165	--	--	460	7,649
Columbia	4	134	55	1,870	--	--	59	1,804
Dauphin	--	--	34	867	--	--	34	867
Lackawanna	9	382	234	8,388	(*)	10	243	9,380
Luverne	662	23,247	956	29,274	4	161	1,522	52,672
Northumberland	183	7,327	614	15,287	1	30	798	22,644
Schuylkill	1,174	47,694	1,819	54,569	5	189	2,997	102,452
Sullivan	--	--	40	551	--	--	40	551
Total ¹	1,992	81,288	4,201	116,812	10	380	6,203	198,481

¹ Data may not add to totals shown because of independent rounding.
² Value given for shipments is that at which coal left possession of producing company; does not include selling expenses.
³ Includes Sullivan County.
⁴ Less than 1,000 short tons.

Table 8.—Pennsylvania anthracite produced, by field
(Thousand short tons)

Field	1971	1972	1973	1974	1975
Eastern Middle: Breakers and washeries	1,519	1,221	1,288	1,156	1,170
Western Middle: Breakers and washeries	2,167	1,741	1,663	1,939	1,451
Dredges	W	W	W	W	W
Total	W	W	W	W	W
Southern: Breakers and washeries	2,849	2,333	2,427	2,693	2,602
Dredges	W	W	W	W	W
Total	W	W	W	W	W
Northern: Breakers and washeries ¹	1,802	1,334	1,011	677	905
Total:	8,337	6,629	6,389	6,466	6,127
Breakers and washeries	390	477	441	150	76
Dredges	8,727	7,106	6,830	6,617	6,203
Grand total	8,727	7,106	6,830	6,617	6,203

W Withheld to avoid disclosing individual company confidential data.
¹ Includes Sullivan County.
² Data do not add to total shown because of independent rounding.

Size		Lehigh region		Schuylkill region		Total	
1971	1972	1973	1974	1975	1976	1977	1978
Lump and broken							
Stove	4.6	2.4	4.6	5.7	10.4	9.1	0.1
Chestnut	10.9	10.6	10.6	12.8	10.7	9.4	8.6
Pee	9.9	8.5	8.5	9.9	10.7	9.4	7.1
Total pee and larger							
Buckwheat No. 1	10.6	12.1	11.8	12.1	10.2	9.0	25.7
Buckwheat No. 2 (rice)	10.7	9.0	9.4	11.1	8.9	8.8	7.5
Buckwheat No. 3 (barley)	10.1	9.1	9.4	11.1	8.9	8.8	7.5
Buckwheat No. 4	5.6	5.9	5.6	9.1	12.7	12.2	10.2
Buckwheat No. 5	12.1	14.5	14.5	16.0	10.7	10.3	20.4
Other ²	12.1	17.1	14.8	14.1	20.8	17.8	22.8
Total buckwheat No. 1 and smaller							
63.6	67.7	64.1	67.5	70.6	72.5	74.4	74.8
Lump and broken							
Stove	4.6	2.4	4.6	5.7	10.4	9.1	0.1
Chestnut	10.9	10.6	10.6	12.8	10.7	9.4	8.6
Pee	9.9	8.5	8.5	9.9	10.7	9.4	7.1
Total pee and larger							
Buckwheat No. 1	10.6	12.1	11.8	12.1	10.2	9.0	25.7
Buckwheat No. 2 (rice)	10.7	9.0	9.4	11.1	8.9	8.8	7.5
Buckwheat No. 3 (barley)	10.1	9.1	9.4	11.1	8.9	8.8	7.5
Buckwheat No. 4	5.6	5.9	5.6	9.1	12.7	12.2	10.2
Buckwheat No. 5	12.1	14.5	14.5	16.0	10.7	10.3	20.4
Other ²	12.1	17.1	14.8	14.1	20.8	17.8	22.8
Total buckwheat No. 1 and smaller							
63.6	67.7	64.1	67.5	70.6	72.5	74.4	74.8
Lump and broken							
Stove	4.6	2.4	4.6	5.7	10.4	9.1	0.1
Chestnut	10.9	10.6	10.6	12.8	10.7	9.4	8.6
Pee	9.9	8.5	8.5	9.9	10.7	9.4	7.1
Total pee and larger							
Buckwheat No. 1	10.6	12.1	11.8	12.1	10.2	9.0	25.7
Buckwheat No. 2 (rice)	10.7	9.0	9.4	11.1	8.9	8.8	7.5
Buckwheat No. 3 (barley)	10.1	9.1	9.4	11.1	8.9	8.8	7.5
Buckwheat No. 4	5.6	5.9	5.6	9.1	12.7	12.2	10.2
Buckwheat No. 5	12.1	14.5	14.5	16.0	10.7	10.3	20.4
Other ²	12.1	17.1	14.8	14.1	20.8	17.8	22.8
Total buckwheat No. 1 and smaller							
63.6	67.7	64.1	67.5	70.6	72.5	74.4	74.8

Table 6.—Sizes of Pennsylvania anthracite (excluding dredge coal) prepared at plants, by region
(Percent)

¹ Less than 0.5%.
² Includes various mixtures of buckwheat Nos. 2 to 5 and coal of relatively low dollar value.

Table 9.—Pennsylvania anthracite produced in 1975, classified as fresh-mined, culm-bank and river coal, by field and region
(Thousand short tons)

Source	Fresh-mined coal					
	Underground mines			From culm banks and river dredging		
	Mechanically loaded	Hand loaded	Total	Strip pits	From culm banks	From river dredging
Eastern Middle	40	67	107	821	349	1,170
Eastern Middle	253	275	528	476	869	1,345
Eastern Middle	6	(3)	6	189	710	895
Total	299	342	641	2,564	2,922	6,203
REGION						
High	293	342	635	1,067	720	1,787
Low	6	(3)	6	189	710	895
Total	299	342	641	2,564	2,922	6,203

W. Withheld to avoid disclosing individual company confidential data.
1. Data may not add to totals shown because of independent rounding.
2. Includes Sullivan County.
3. Less than 1,000.

Table 10.—Production of Pennsylvania anthracite from strip pits

	Mined by striping (thousand short tons)	Percentage of fresh-mined total	Number of men employed	Average number of days worked
1	4,478	77.7	1,800	273
2	3,488	78.7	2,011	261
3	3,278	81.3	1,693	260
4	2,869	81.4	1,376	244
5				
6				
Lehigh region	1,067	33.0	NA	NA
Schuylkill region	1,318	41.1	NA	NA
Wyoming region	189	5.8	NA	NA
Total or average	2,664	79.9	1,463	213

NA Not available.
1. Includes Sullivan County.

Table 11.—Power shovels, front-end loaders, and draglines used in recovering coal from culm banks and stripping Pennsylvania anthracite, by type of power

Type of power	1973				1974				1975			
	Number of front-end loaders	Number of power shovels	Number of drag-lines	Total	Number of front-end loaders	Number of power shovels	Number of drag-lines	Total	Number of front-end loaders	Number of power shovels	Number of drag-lines	Total
Gasoline	—	16	34	50	—	2	2	4	—	4	1	5
Electric	188	34	77	249	146	14	30	44	179	13	27	40
Diesel	—	—	—	—	—	27	73	246	—	88	98	315
Diesel-electric	—	—	—	—	—	—	—	—	—	1	1	2
Total	188	50	112	300	146	43	105	294	179	56	127	362

Table 12.—Production of Pennsylvania anthracite from culm banks, by region
(Thousand short tons)

Year	Lehigh region	Schuylkill region	Wyoming region	Total
1971	729	1,544	800	2,573
1972	614	1,411	177	2,202
1973	611	1,612	161	2,384
1974	468	2,037	435	2,940
1975	720	1,492	710	2,922

Table 13.—Estimated production of Pennsylvania anthracite in 1975, by week¹

Week ended—	Thousand short tons	Week ended—	Thousand short tons	Week ended—	Thousand short tons
Jan. 4	70	May 17	144	Sept. 13	126
11	140	24	124	20	136
18	105	31	108	27	91
25	110	June 7	136	Oct. 4	107
Feb. 1	115	14	116	11	146
8	148	21	126	18	131
15	138	28	151	25	111
22	117	July 5	50	Nov. 1	106
Mar. 1	132	12	70	8	142
8	156	19	150	15	136
15	121	26	114	22	142
22	126	Aug. 2	106	29	135
29	121	9	125	6	168
Apr. 12	80	17	154	13	145
19	35	23	116	20	139
26	40	30	120	27	109
May 3	120	Sept. 6	106	Jan. 3	79
10	139			Total	6,203

¹ Estimated from weekly carloadings as reported by the Association of American Railroads and other factors; adjusted to annual production from Bureau of Mines canvass.

² Figures represent production in that part of week included in calendar year shown.

Table 14.—Estimated monthly production of Pennsylvania anthracite¹
(Thousand short tons)

Month	1971	1972	1973	1974	1975
January	725	583	622	516	640
February	654	542	568	458	535
March	780	622	641	531	544
April	785	487	581	563	270
May	782	706	641	589	535
June	740	515	609	505	544
July	620	465	434	443	458
August	813	688	587	620	535
September	767	611	532	518	500
October	710	682	614	641	560
November	685	650	582	610	555
December	656	555	519	625	630
Total	8,727	7,106	6,830	6,617	6,203

¹ Production is estimated from weekly carloadings, as reported by the Association of American Railroads, and includes mine fuel, coal sold locally, and dredge coal.

Table 15.—Pennsylvania anthracite loaded mechanically underground
(Thousand short tons)

Year	Scraper loaders		Mobile loaders		Conveyor and pit-car loaders		Total loaded mechanically ¹
	Num-ber of units	Quan-tity loaded	Num-ber of units	Quan-tity loaded	Num-ber of units	Quan-tity loaded	
1971	95	319	18	151	91	199	670
1972	81	347	16	136	46	111	694
1973	72	220	4	106	47	96	421
1974	64	89	6	169	41	49	307
1975	15	68	4	188	25	44	299

¹ Data may not add to totals shown because of independent rounding.

Table 16.—Trends in mechanical loading,¹ hand loading, stripping of Pennsylvania anthracite, fresh-mined coal
(Thousand short tons)

Year	Underground				Strip pits		
	Mechan-ical load-ing	Percent-age of total under-ground	Hand load-ing	Percent-age of total under-ground	Quan-tity	Percent-age of fresh-mined coal	Total
1971	670	52.1	617	47.9	1,287	77.7	5,765
1972	594	62.9	350	37.1	944	78.7	4,427
1973	421	58.0	305	42.0	726	81.9	4,005
1974	307	46.8	350	53.2	657	81.4	3,526
1975	299	46.6	342	53.4	641	80.0	3,205

¹ Mechanical loading includes coal handled on pit-car loaders and hand-loaded face conveyors.

Table 21.—Distribution of Pennsylvania anthracite, calendar year 1975, by State, Province, or country of destination
(Short tons)

(Short tons)											
Destination	Pea and larger					Buckwheat No. 1 and smaller					Total all sizes
	Broken and egg	Stove	Chestnut	Pea	Total	Buck- wheat No. 1	Buck- wheat No. 2 (Rice)	Buck- wheat No. 3 (Barley)	Other	Total	
United States:											
New England States:											
Connecticut	--	2,052	2,627	--	4,679	582	153	--	187	922	5,601
Maine	--	1,186	1,589	56	2,781	--	863	--	304	1,167	3,948
Massachusetts	789	5,122	4,774	1,077	11,762	2,287	1,063	--	1,878	5,228	16,990
New Hampshire	--	1,205	1,299	30	2,534	184	192	1	8	385	2,919
Rhode Island	--	773	1,116	--	1,889	123	--	--	--	123	2,012
Vermont	--	1,771	1,580	111	3,462	1,806	2,786	--	59	4,651	8,113
Total	789	12,059	12,985	1,274	27,107	4,982	5,057	1	2,436	12,476	39,588
Middle Atlantic States:											
New Jersey	887	9,091	24,254	5,208	39,440	3,525	2,852	2,611	80,691	89,679	129,119
New York	611	77,910	49,996	97,162	225,679	73,507	40,896	67,737	64,983	247,123	472,802
Pennsylvania ¹	3,926	108,330	249,043	214,564	575,863	284,984	389,786	437,163	1,895,096	3,007,029	3,582,892
Total	5,424	195,331	323,293	316,934	840,982	362,016	433,534	507,511	2,040,770	3,343,831	4,184,813
South Atlantic States: ²											
Delaware	670	1,894	2,477	752	5,793	25	--	3,540	8	3,568	9,361
District of Columbia	--	2,197	1,773	169	4,139	238	121	--	--	359	4,498
Maryland	--	5,668	6,628	242	12,538	327	303	163	2,356	3,149	15,687
Virginia	--	430	433	--	863	--	1,030	--	1,764	2,794	3,657
West Virginia	--	--	79	7,562	7,641	127	2	2	27,600	27,731	35,372
Total	670	10,189	11,390	8,725	30,974	717	1,456	3,705	31,723	37,601	68,575
Lake States:											
Illinois	7,090	--	907	1,978	9,975	23,227	7,344	360	5,467	36,398	46,373
Indiana	--	--	640	(-18)	622	49	78	71	24,334	24,532	25,154
Michigan	2,492	57,165	8,815	7,600	76,062	1,590	177	14	2,402	4,183	80,245
Minnesota	--	--	5	5	10	6	1	4	13,889	13,900	13,910
Ohio	7,820	3,035	4,149	2,485	17,489	27,379	5,915	637	29,416	63,347	80,836
Wisconsin	--	1,130	1,155	54	2,339	3	33	3	2,569	2,608	4,947
Total	17,402	61,320	15,671	12,104	106,497	52,254	13,548	1,089	78,077	144,968	251,465

Other States	902	2,062	445	22,123	25,532	82,927	1,686	9,421	186,934	230,968	306,500
Total United States	25,187	280,961	363,784	361,160	1,031,092	502,896	456,281	521,727	2,339,940	3,819,844	4,850,936
Canada:											
Ontario	173	34,486	30,719	5,022	70,400	21,554	4,518	1,045	16,425	43,542	113,942
Quebec	--	715	6,023	3,164	9,902	26,398	33,942	148,923	208,975	418,238	428,140
Other Provinces	--	668	662	6	1,324	6	61	6	73	146	1,470
Total Canada	173	35,867	37,404	8,192	81,626	47,958	38,521	149,974	225,473	461,926	543,552
Other countries											
Grand total	93,480	203,318	165,804	18,613	481,215	4,290	1,609	2,484	62,143	70,526	551,741
	118,840	520,136	566,992	387,965	1,593,933	555,144	495,411	674,185	2,627,556	4,352,296	5,946,229

¹ Includes "Local sales."

² Shipments to other States in the South Atlantic area are included in "Other States."

Table 22.—Truck shipments of Pennsylvania anthracite in 1975, by month and State of destination¹
(Thousand short tons)

Destination	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total	Percent trucked
Pennsylvania:														
Within region	181	127	145	102	92	82	95	102	96	89	80	117	1,288	35.8
Outside region	101	159	106	90	127	170	184	172	147	193	118	876	1,923	54.2
New York	38	27	26	11	24	33	24	25	29	27	18	18	300	8.4
New Jersey	8	3	5	(*)	4	3	6	5	6	5	7	7	56	1.6
New York State	1	1	1	(*)	1	(*)	1	1	1	1	1	1	9	.3
Other States	1	1	(*)	(*)	1	1	1	1	1	1	1	1	9	.3
Total: 1975	314	358	284	193	249	293	259	306	280	318	223	524	3,601	100.0
Total: 1974	375	295	282	312	271	325	295	326	344	362	394	386	3,917	100.0

Compiled from reports of Pennsylvania Department of Mines and Mineral Industries; does not include dredge coal.

Less than 1/2 unit.

Data may not add to totals shown because of independent rounding.

Table 23.—Shipments of Pennsylvania anthracite, by destination¹
(Thousand short tons)

Destination	1971	1972	1973	1974	1975
TRUCK SHIPMENTS					
Pennsylvania:					
Within region	1,880	1,584	1,511	1,410	1,288
Outside region	2,069	1,793	1,708	1,943	1,923
New York	373	441	380	416	300
New Jersey	126	89	77	77	66
New York State	17	16	11	9	9
Other States	29	23	26	30	9
Total: 1975	4,487	3,966	3,771	3,917	3,601
RAIL SHIPMENTS					
England States	100	49	45	37	29
New York	532	281	299	187	106
New Jersey	113	85	55	34	55
Pennsylvania	819	830	856	679	586
New York State	24	2	1	23	1
Other States	7	3	2	15	5
Total: 1975	1,555	1,249	1,252	956	770
Total United States ²	2,366	1,891	1,977	1,649	1,280
Other countries	411	386	389	348	303
Grand total ³	4,349	3,349	3,349	3,349	3,349

Compiled from reports of Pennsylvania Department of Mines and Mineral Industries; does not include dredge coal.

Less than 1/2 unit.

Data may not add to totals shown because of independent rounding.

Corrected figure; erroneously reported in 1971 and 1972.

Table 24.—Consumption of Pennsylvania anthracite in the United States, by consumer category
(Thousand short tons)

Year	Residential and commercial heating ¹	Colliery fuel	Electric utilities ¹	Cement plants	Iron and steel industry	Other uses ²
1971	3,850	15	1,646	W	421	339
1972	2,960	11	1,584	W	474	283
1973	2,917	11	1,442	W	467	281
1974	2,577	12	1,498	W	444	287
1975	2,128	10	1,482	W	326	287

W Withheld to avoid disclosing individual company confidential data; included in "Other uses."

¹ Federal Power Commission.

² Annual Statistical Report, American Iron and Steel Institute.

³ Annual Statistical Report, U.S. Bureau of Mines.

Table 25.—U.S. exports of anthracite, by country and customs district

COUNTRY	1974			1975		
	Quantity (short tons)	Value (thou. \$)	Value (thou. \$)	Quantity (short tons)	Value (thou. \$)	Value (thou. \$)
Argentina	27,347	4,482	4,482	31	1,868	286
Australia	1,459	9,772	9,772	1,071	171	171
Brazil	4,195	481,345	481,345	648,562	20,906	20,906
Canada	—	—	—	674	33	33
Chile	—	—	—	57	10	10
China, People's Republic of	3	—	—	10	1	1
Colombia	12	—	—	568	97	97
Dominican Republic	194	19	19	—	—	—
Ecuador	60	4	4	—	—	—
Finland	165,966	3,700	3,700	39,393	1,425	1,425
France	4	—	—	2,215	147	147
India	905	67	67	11,857	331	331
Iran	18,470	683	683	142	7	7
Italy	10,317	412	412	12,128	722	722
Korea, Republic of	11,341	366	366	16,362	717	717
Mexico	62	31	31	—	—	—
Netherlands	1,541	127	127	225	16	16
Panama	1,541	69	69	344	261	261
Philippines	3,271	265	265	212	18	18
Sweden	4,212	231	231	5,758	499	499
Trinidad and Tobago	1,595	142	142	—	—	—
Venezuela	1,100	33	33	361	19	19
Other	735,173	16,577	16,577	639,601	25,801	25,801
Total	23,514	551	551	438	65	65
CUSTOMS DISTRICT						
Baltimore	128,260	3,120	3,120	127,829	4,065	4,065
Buffalo	7,871	191	191	22,577	967	967
Detroit	—	—	—	335	11	11
El Paso	23	—	—	674	38	38
Galveston	197	—	—	359	—	—
Great Falls	10,317	412	412	11,540	769	769
Houston	11	—	—	92	2	2
Laredo	162	394	394	272	48	48
Miami	6,280	244	244	2,957	501	501
Mobile	3,519	250	250	1,011	58	58
New Orleans	45,062	1,028	1,028	72,739	2,117	2,117
New York City	1,697	83	83	397,497	17,143	17,143
Nogales	505,775	10,394	10,394	390	15	15
Ogdensburg	139	2	2	256	21	21
Pembina	1,407	104	104	212	18	18
Philadelphia	—	—	—	—	—	—
Portland, Maine	184	3	3	—	—	—
San Francisco	765	14	14	75	5	5
San Juan	—	—	—	—	—	—
Savannah	—	—	—	—	—	—
Seattle	735,173	16,577	16,577	639,601	25,801	25,801
Total	735,173	16,577	16,577	639,601	25,801	25,801

TABLE 9-21. 1990 BOILER COSTS: FRUIT AND VEGETABLE
CANNING MODEL PLANT

Costs	Base Case ^a	Regulatory Option	
		I ^b	V ^c
Total boiler and pollution control capital costs, 1978\$	2,334,760	2,427,760	2,427,760
Annualized total boiler costs, \$/GJ (\$/MMBtu)			
Capital	0.66 (0.70)	0.69 (0.73)	0.69 (0.73)
O&M	1.42 (1.50)	1.56 (1.65)	1.56 (1.65)
Fuel	5.12 (5.40)	5.12 (5.40)	5.12 (5.40)
Total	7.19 (7.59)	7.36 (7.77)	7.36 (7.77)
Control Technology			
NO _x	---	Combustion Modification	Combustion Modification

^aThe base case contains no regulations for these boilers.

^bRegulatory Option I contains an 86 ng/J (0.2 lb/MMBtu) NO_x regulation for these boilers.

^cRegulatory Option I contains an 86 ng/J (0.2 lb/MMBtu) NO_x regulation for these boilers.

Cobalt

By Scott F. Sibley¹

Demand for cobalt declined significantly in 1975 in line with general industrial activity. However, consumption accelerated during the last quarter. Total reported consumption of cobalt in the United States in 1975 was 12.8 million pounds, the lowest since 1971 and 32% below that of 1974. The major decreases in consumption in order were superalloys, magnetic alloys, and cutting and wear-resistant materials. Government releases of cobalt from the strategic stockpile were a significant source of supply during 1975, with over 6.3 million pounds delivered to consumers.

Legislation and Government Programs.—The General Services Administration (GSA) continued to offer cobalt metal in various forms for sale during 1975. Sales were on an unrestricted-bid basis except that total sales of specification-grade material were limited to about 1 million pounds per month and 500,000 pounds per bidder per month. The stockpile objective for cobalt remained at 11,945,000 pounds in 1975. As of December 31, 1975, the total U.S. Government stockpile inventory was 47,649,355 pounds of cobalt. Government sales of cobalt for the year totaled 4,896,384 pounds, compared with 8,649,811 pounds sold in 1974. Deliveries of cobalt from Government stockpiles from current or prior year sales totaled 6,345,327 pounds.

Table 1.—Salient cobalt statistics
(Thousand pounds of contained cobalt)

	1971	1972	1973	1974	1975
United States:					
Consumption	12,600	14,130	18,741	18,861	12,787
Imports for consumption	10,912	18,916	18,238	16,122	6,608
Stocks, Dec. 31: Consumer	1,411	1,198	2,461	2,047	1,887
Price: Metal, per pound	\$2.20-\$2.45	\$2.46	\$2.45-\$3.10	\$3.10-\$3.75	\$3.75-\$4.00
World: Production, mine	64,598	64,762	64,856	71,582	72,564

DOMESTIC PRODUCTION

There was no domestic mine production of cobalt in 1975. However, Ammax Inc. continued to refine cobalt at its refinery in Brathwaite, La. The production level rose to about 30% of capacity in October 1975 and was expected to reach 75% of capacity in 1976. This could result in a production of 900,000 pounds of cobalt for 1976. Nickel-cobalt and copper-cobalt matte was supplied to the plant from New Caledonia, Botswana, and the Republic of South Africa. Total cobalt production at the refinery in 1975 was 65,000 pounds.

An international consortium was formed to recover cobalt-bearing manganese nodules from the sea floor, raising to three the number of organizations with American interests active in ocean mining research and development. Participants in the venture were International Nickel Co. Inc. of both Canada and the United States; Deep Ocean Mining Co. of Japan; and a German group comprised of Metallgesellschaft AG; Preussag AG; Rheinische Braunkohlenwerke AG; and Salzgitter AG.

Year	Total production (short tons) ¹	Method of production (short tons)				Average productivity, tons per man-day		Quantity loaded mechanically underground (short tons)	Percentage of total loaded underground
		Deep mine	Strip	Culm	Dredge	Total	Strip		
1934	57,168,291	48,574,741	5,798,138	NA	652,180	2.53	NA	9,284,486	19.1
1935	52,158,783	43,782,876	5,187,072	2,702,468	590,467	2.68	NA	9,279,057	21.2
1936	54,579,535	44,726,506	6,203,267	3,193,972	546,684	2.79	NA	10,827,946	24.2
1937	51,856,433	42,566,351	5,696,018	2,722,599	760,474	2.77	NA	10,683,837	25.1
1938	46,099,027	38,142,297	5,095,341	2,340,444	571,024	2.79	NA	10,161,669	26.6
1939	51,487,877	42,571,548	5,486,479	2,583,814	703,860	3.02	NA	11,773,833	27.7
1940	51,484,640	41,516,837	6,352,700	2,783,038	942,944	3.02	NA	12,326,000	29.7
1941	56,368,267	43,877,264	7,316,574	3,656,866	1,517,563	3.04	NA	13,441,987	30.6
1942	60,327,729	45,236,699	9,070,933	4,735,064	1,285,033	2.95	NA	14,741,459	32.6
1943	60,643,620	42,735,798	8,989,387	7,583,698	1,334,737	2.78	NA	14,745,793	34.5
1944	68,701,363	41,775,416	10,953,030	9,600,180	1,372,737	2.79	NA	14,975,146	35.8
1945	54,933,909	34,885,699	10,056,325	8,786,659	1,205,226	2.79	NA	13,927,955	39.9
1946	60,506,873	38,084,457	12,868,903	8,431,092	1,132,394	2.84	NA	15,619,162	41.0
1947	57,190,009	36,963,112	12,603,545	6,403,646	1,219,706	2.78	NA	16,054,011	43.4
1948	57,139,948	37,175,291	13,352,874	5,623,779	988,004	2.81	NA	15,742,368	42.3
1949	42,701,724	27,030,650	10,376,808	4,429,144	865,122	2.87	NA	11,858,088	43.9
1950	44,076,703	28,155,895	11,833,934	3,467,310	619,564	2.83	NA	12,835,650	43.8
1951	42,669,997	26,342,239	11,135,990	4,630,200	561,668	2.97	NA	10,847,787	41.2
1952	40,582,558	24,748,283	10,696,705	4,765,516	372,054	3.06	NA	10,034,464	40.5
1953	30,949,152	17,893,489	8,606,482	4,011,000	438,181	3.28	NA	6,838,769	38.2
1954	29,083,477	16,852,408	7,939,680	3,565,482	725,907	4.02	NA	6,978,035	41.4
1955	26,204,554	14,498,758	7,703,907	3,213,046	788,843	3.96	NA	6,660,939	45.9
1956	28,900,220	15,054,904	8,354,230	4,774,799	716,287	4.25	NA	7,308,110	48.5
1957	25,338,321	12,616,053	7,543,157	4,521,410	657,701	4.18	NA	6,657,479	52.8
1958	21,171,142	10,698,835	6,877,761	2,902,763	691,798	4.36	7.94	5,332,043	49.8
1959	20,649,286	9,415,470	7,096,343	3,420,854	716,619	5.12	9.40	4,700,542	49.9
1960	18,817,441	7,695,978	7,112,288	3,297,012	712,163	5.60	10.51	4,044,392	52.6
1961	17,446,439	6,784,586	7,246,646	2,669,359	745,848	5.63	10.96	3,337,778	49.8
1962	16,893,646	6,672,922	6,822,207	2,671,466	727,051	5.92	11.01	3,065,364	45.9
1963	18,267,384	6,714,746	7,467,842	3,393,066	691,730	6.27	11.02	3,665,962	54.6
1964	17,184,251	5,888,826	7,177,138	3,412,989	705,248	6.11	10.76	3,465,034	58.7
1965	14,865,955	5,296,989	5,938,982	2,929,527	700,457	6.55	11.65	3,246,034	61.3
1966	12,941,264	4,088,144	5,253,408	2,938,095	651,617	6.87	NA	2,590,547	63.4
1967	12,266,063	3,258,000	4,740,187	3,627,000	631,660	7.21	NA	1,997,806	61.3
1968	11,460,833	2,450,000	4,696,163	3,709,000	605,920	7.62	NA	1,475,000	60.2
1969	10,472,916	2,106,000	4,578,732	3,253,000	535,869	7.45	10.06	1,326,598	63.0
1970	9,729,398	1,742,000	4,541,452	3,036,000	409,354	7.10	8.98	1,150,596	66.1
1971	8,727,325	1,286,666	4,478,350	2,572,700	389,609	6.30	8.34	669,961	52.1
1972	7,106,295	944,000	3,483,000	2,202,000	476,792	6.88	NA	593,997	62.9
1973	6,829,961	726,000	3,279,000	2,384,000	441,076	7.15	NA	421,000	58.0
1974	6,616,866	657,000	2,869,000	2,940,000	150,468	7.87	NA	307,000	46.8
1975	6,203,310	641,000	2,564,000	2,922,000	76,142	7.46	NA	299,000	46.6

NA Not available.
¹ Data may not add to totals shown because of independent rounding.
Sources: Minerals Yearbook (Fuels), Bureau of Mines, U.S. Department of the Interior; and Selected Annual Reports, Pennsylvania Department of Environmental Resources, Office of Mines and Land Protection.

¹ Physical scientist, Division of Ferrous Metals.