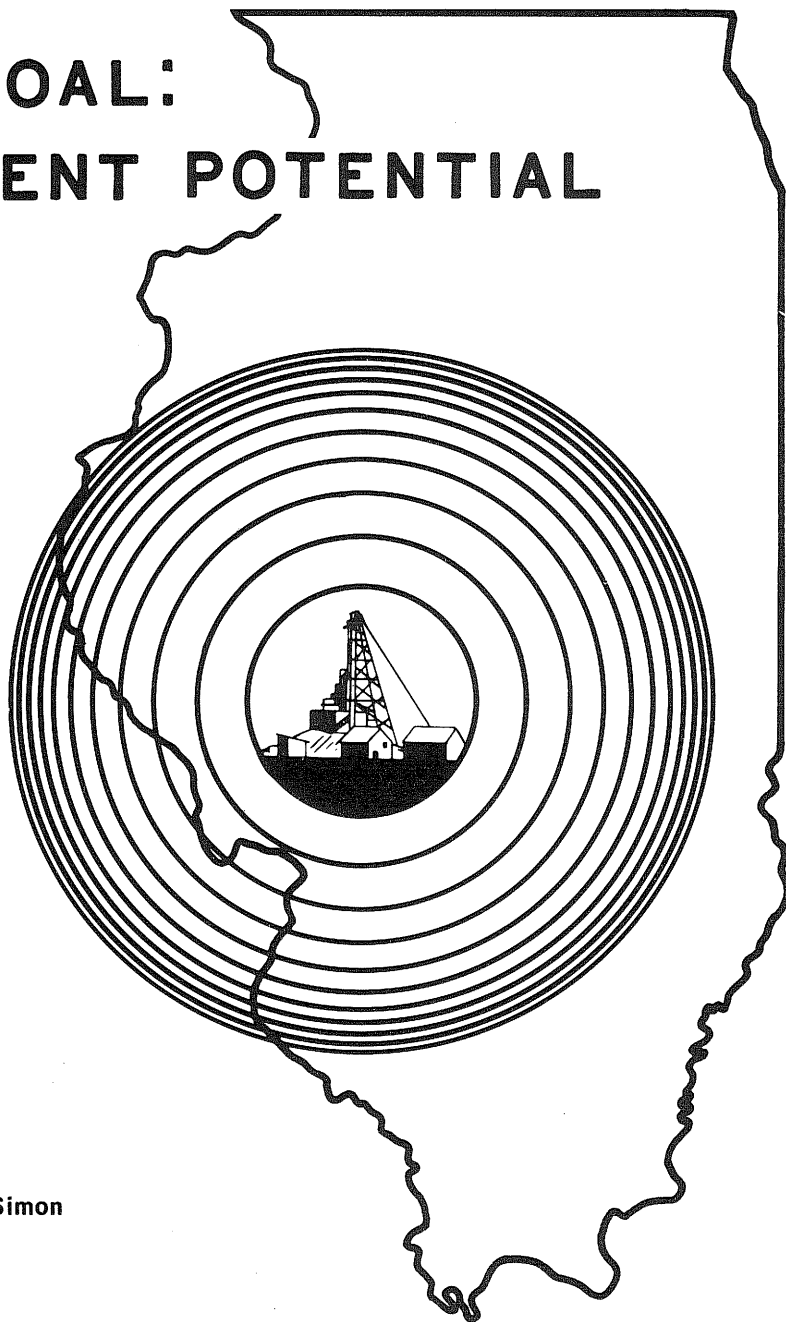


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# ILLINOIS COAL: DEVELOPMENT POTENTIAL



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ILLINOIS STATE GEOLOGICAL SURVEY

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## ILLINOIS COAL: DEVELOPMENT POTENTIAL\*

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### INTRODUCTION

Within the last few years increasing awareness of the energy problems in the United States and the projected shortfall of the oil and natural gas supply from domestic fields have led to concerted efforts to develop the nation's principal energy resource, coal. The Federal Energy Administration (FEA) estimates that by 1985 United States coal production may have to increase to 1.0 billion tons under a *reference scenario* and to more than 1.2 billion tons under an *electrification scenario* (Federal Energy Administration, 1976). Since United States coal production in 1975 totaled approximately 640 million tons (U.S. Bureau of Mines, 1976a), the projection suggests that coal production will have to about double by 1985.

In this paper, we have examined the position of Illinois coal reserves and the future coal supply that may be needed from Illinois mines through 1985. We have also discussed briefly the factors that appear to be limiting Illinois coal development.

### COAL AS A SOURCE OF ENERGY

Let us briefly examine some of the reasons that favor extensive use of coal to supply energy for the future needs of the United States. Figure 1 shows fossil fuels and uranium reserves that are available in the United States

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and the energy potential that each of these energy fuels offers. Of the total estimated 56 quintillion ( $55.6 \times 10^{18}$ ) Btu of energy available from domestic fossil fuels and uranium, more than 60 percent occurs in coal (Federal Power Commission, 1974). Oil shale and tar sand together rank second, but no significant production of either has been achieved, although both have been of great interest in the United States for 25 years or longer. Oil and natural gas, which currently supply more than 75 percent of the total energy used, account for only about 10 percent of the total energy potentially available from fossil fuels. The expanded use of these limited energy sources has already made our nation increasingly dependent on foreign oil-producing nations. The energy potential of uranium under present conventional use is limited. With the development of a breeder reactor, uranium resources would ultimately have an energy potential about twice as great as that estimated for our coal reserves. However, since breeder reactor technology is not yet commercially available, the potential for energy available from uranium reserves must for the present be considered limited.

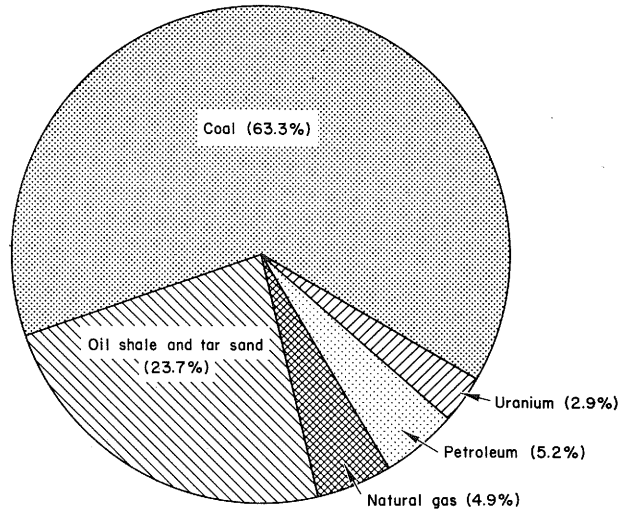


Fig. 1 - Coal in relation to other major sources of energy in the United States. Total energy available from these sources is estimated at  $55.6 \times 10^{18}$  Btu. (Source of data: Federal Power Commission, 1974.)

Hydropower and geothermal are other sources of energy that currently supply energy for our nation's needs. In the future these sources of energy are expected to continue to provide energy, but their use is likely to be of only local importance and only a small portion of the total energy needs is expected to be met by these sources.

The unconventional sources of energy that are in the news and that are being considered as potential future sources of energy supply include solar power, nuclear fusion, wind power, tidal power, and others. The technology for the use of all of these sources except solar power either has not been fully proven or is of only local significance. Efforts are being made to develop technologies that would make the use of solar power economically feasible. Some projections suggest widespread application of this energy source before the end of this century. Even if the installation of solar systems does become economically feasible, we do not believe that it will have a major impact on total energy needs, at least not in the next 20 years.

From this brief review of potential sources of energy, it is clear that coal is a principal energy source upon which the nation could depend for a substantial part of its future energy needs, especially for the rest of this century. In addition to being the principal United States energy resource, coal has long been an important source of energy. Shortly after World War I, coal provided more than 75 percent of the total energy used in the United States. Oil and natural gas, however, were favored by technological develop-

ments, and in 1946 these fuels surpassed coal as the nation's principal source of energy. The role of coal has declined since then, but coal still accounts for a substantial portion of the total energy used. It provided more than 18 percent of the total energy used in 1975.

In addition to conventional direct utilization, coal offers promise as a source for the production of synthetic fuels, such as low-Btu gas, pipeline-quality gas, petroleum, and solvent-refined products, that could substitute for the natural oil and gas that are in increasingly short supply. With projected shortfall of the future oil and natural gas supply, the use of coal to produce chemical feedstock is also being considered; coal had been used for this purpose before being displaced by oil and gas.

#### POSITION OF ILLINOIS COAL IN THE UNITED STATES

In the United States occurrence of coal has been reported in at least 34 states, but 12 states possess more than 90 percent of the identified United States coal resources, estimated by the U.S. Geological Survey to be 1.73 trillion tons (Averitt, 1975). Figure 2 shows the distribution of these resources in those 12 states; four states, North Dakota, Montana, Illinois, and Wyoming, together account for more than half of the nation's identified coal resources. Other states having large coal resources include Alaska, Colorado, West Virginia, Pennsylvania, Kentucky, New Mexico, Ohio, and Indiana. In order of rank, Illinois is third after North Dakota and Montana.

Figure 2 also shows the coal reserves, that portion of the identified coal resources that the U.S. Bureau of Mines estimated to be suitable for mining by 1974 mining methods (U.S. Bureau of Mines, 1974b). Montana, which ranks second—after North Dakota—in identified coal resources, leads the nation in coal reserves. In Illinois about 45 percent (65.7 billion tons) of the state's total identified resources (140 billion tons) has been estimated to be minable by 1974 mining methods; this figure places Illinois second in the nation—after Montana—in reserves. Of this amount, the U.S. Bureau of Mines (1974b) estimated that 53.4 billion tons is minable by underground methods of mining and the remaining 12.2 billion tons by surface-mining methods. In a recent State Geological Survey report (Smith, 1975), the total identified coal resources estimate was updated to more than 160 billion tons—20 billion tons more than the earlier estimate.

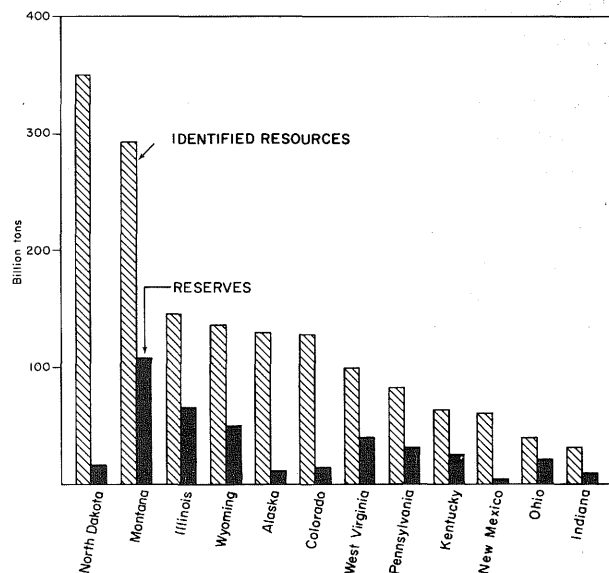


Fig. 2 - Distribution of identified coal resources and reserves in the 12 leading states. (Source of data: Averitt, 1975.)

There is a substantial difference in the heating value of coals. For example, the average heating value (moist, mineral-free basis) of bituminous coal ranges from 10,500 to more than 14,000 Btu/lb, that of subbituminous from 8,300 to 10,500 Btu/lb, and that of lignite, which is the lowest, from 6,300 to 8,300 Btu/lb. Since most of the coal found in North Dakota is lignite and most in Montana is either lignite or subbituminous, a uniform comparison of coal resources can be made only by taking heating value into consideration. In figure 3 such a comparison is shown. The coal resources of Montana and North Dakota, each of which amounts to 2 to 3 times the Illinois coal resources in tonnage, are only slightly higher than Illinois coal on a Btu basis. Colorado's coal resources rank sixth in tonnage but fourth in Btu content.

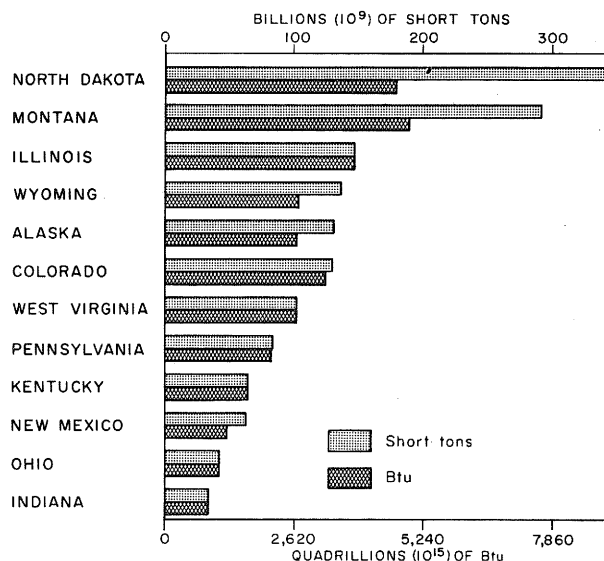


Fig. 3 - Identified coal resources in the 12 leading states, January 1, 1974, according to tonnage (upper bar) and heat value (lower bar). (Adapted from Averitt, 1975.)

Following the introduction of the Clean Air Act of 1970, the sulfur content of coal has become a more significant factor in the evaluation of coal resources. Figure 4 shows the distribution of low-sulfur (< 1% sulfur) coal reserves estimated to be minable by 1974 methods of mining. Most of the low-sulfur coals in the United States occur in states west of the Mississippi River. In Montana, according to the U.S. Bureau of Mines estimates, more than 94 percent of the total coal reserves contain less than 1 percent sulfur (U.S. Bureau of Mines, 1975). In other western states (North Dakota, Wyoming, Colorado, Utah, Arizona, and New Mexico), the proportion of the total coal reserves estimated to contain less than 1 percent sulfur ranges from 30 to 80 percent. Some low-sulfur coals are also found in states east of the Mississippi River. The principal eastern states where low-sulfur coals are found are West Virginia, Virginia, Kentucky (eastern part), and Alabama. Most of the low-sulfur coal produced in these states is shipped for metallurgical or industrial use. Low-sulfur coals occur in Illinois, Indiana, Ohio, and Kentucky (western part), but in all of these four areas except Indiana, they account for less than 3 percent of the area's total coal reserves.

Accessibility to the market is also an important factor in the evaluation of coal resources. Figure 5 shows coal consumption in various states. In 1975 the states east of the Mississippi River consumed more than 80 percent of the coal used in the United States (U.S. Bureau of Mines, 1976b). Midwestern states (Ohio, Illinois, Indiana, Michigan, and Wisconsin) led in consumption as a group, accounting for more than 35 percent of the total. A recent U.S. Bureau of Mines report (Larwood and Benson, 1976) indicates that in 1985 about 74 percent of the total coal consumed in the United States will be used in states east of the Mississippi River. According to this forecast, consumption of coal in both Ohio and Pennsylvania in 1985 will exceed 100 million

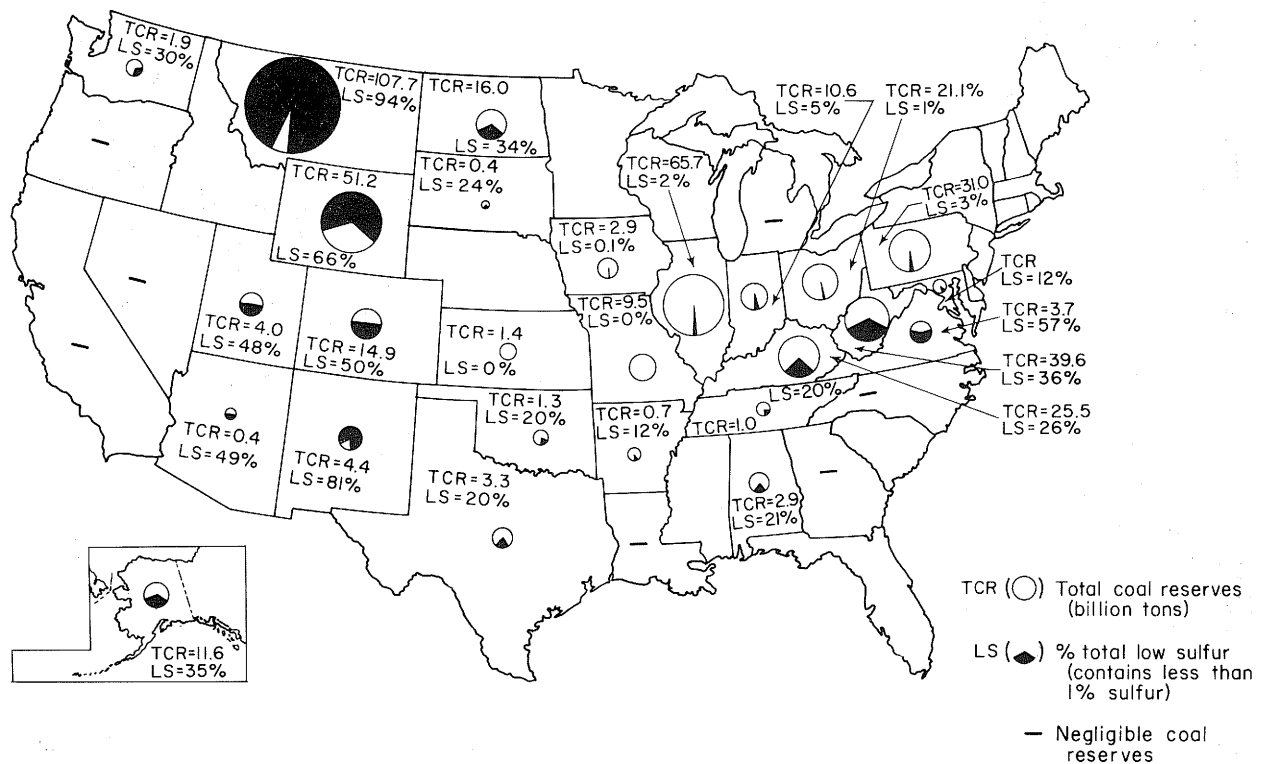


Fig. 4 - Distribution of low-sulfur coal reserves in the United States. Total coal reserves = 433.9 billion tons; low-sulfur coal reserves = 193.8 billion tons. (Source of data: U.S. Bureau of Mines, 1975.)

tons. In Indiana the coal consumption is projected to increase to 86 million tons, and within Illinois coal consumption will increase to more than 75 million tons. In Texas more than 57 million tons of coal are projected to be used in 1985, slightly higher than the 56.7 million tons projected to be used in West Virginia in 1985 (fig. 6). The geographical location of Illinois coal reserves near the areas where substantial increase in coal demand is projected to develop makes Illinois coal reserves a vital source of energy for the needs of the United States.

The need for large quantities of water for the production of synthetic fuel has made availability of water another important aspect of coal resources evaluation. A recent report by the Illinois State Water Survey stated that Illinois water for coal conversion plants could be supplied to a plant anywhere along the major rivers—the Mississippi, Ohio, Wabash, Illinois, or Rock. Minimum flow in the Mississippi River "could supply numerous coal conversion plants, each using water at a rate of 72 mgd [million gallons per day]. At 228 locations at least 6 mgd could be supplied to a coal conversion plant from a man-made reservoir. At 17 locations a system of wells could be constructed to provide a water supply of at least 14 mgd for coal conversion" (Stall, 1975, p. 52). The availability of water in combination with the occurrence of large coal reserves in Illinois is bound to make the state a favorable location for synthetic-fuel plants.

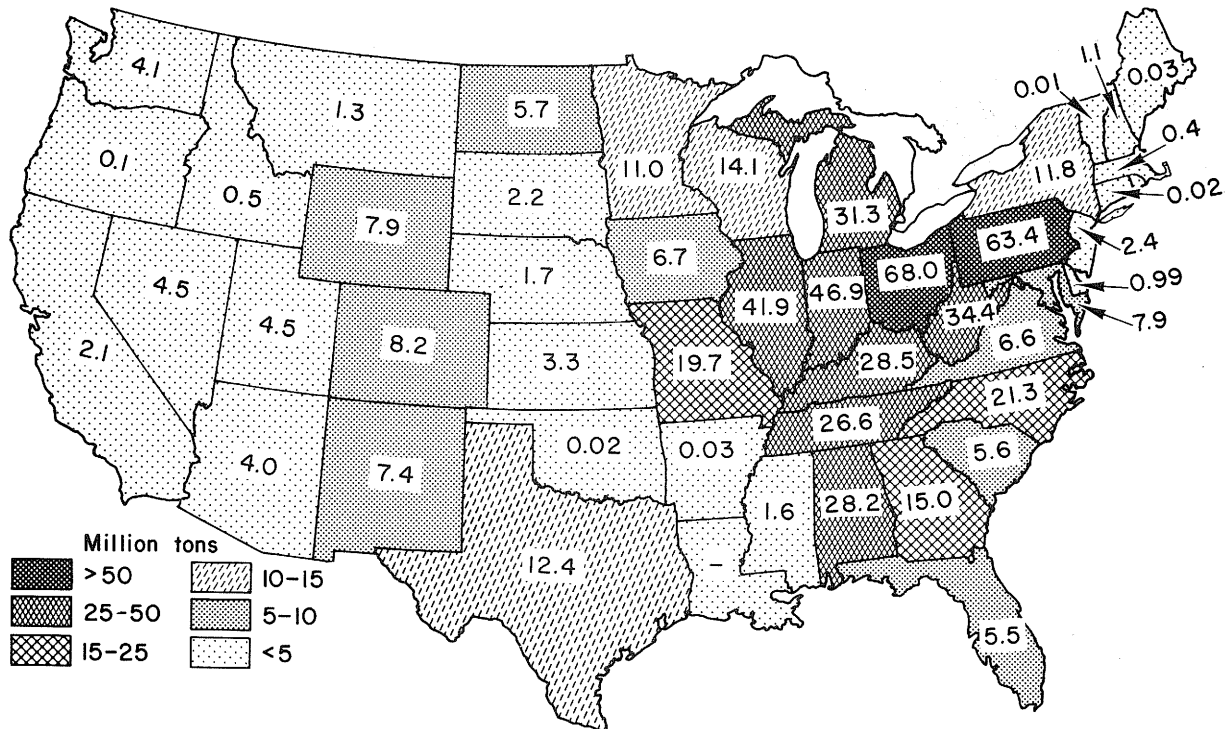


Fig. 5 - Consumption of coal in the United States in 1975. (Source of data: U.S. Bureau of Mines, 1976b.)

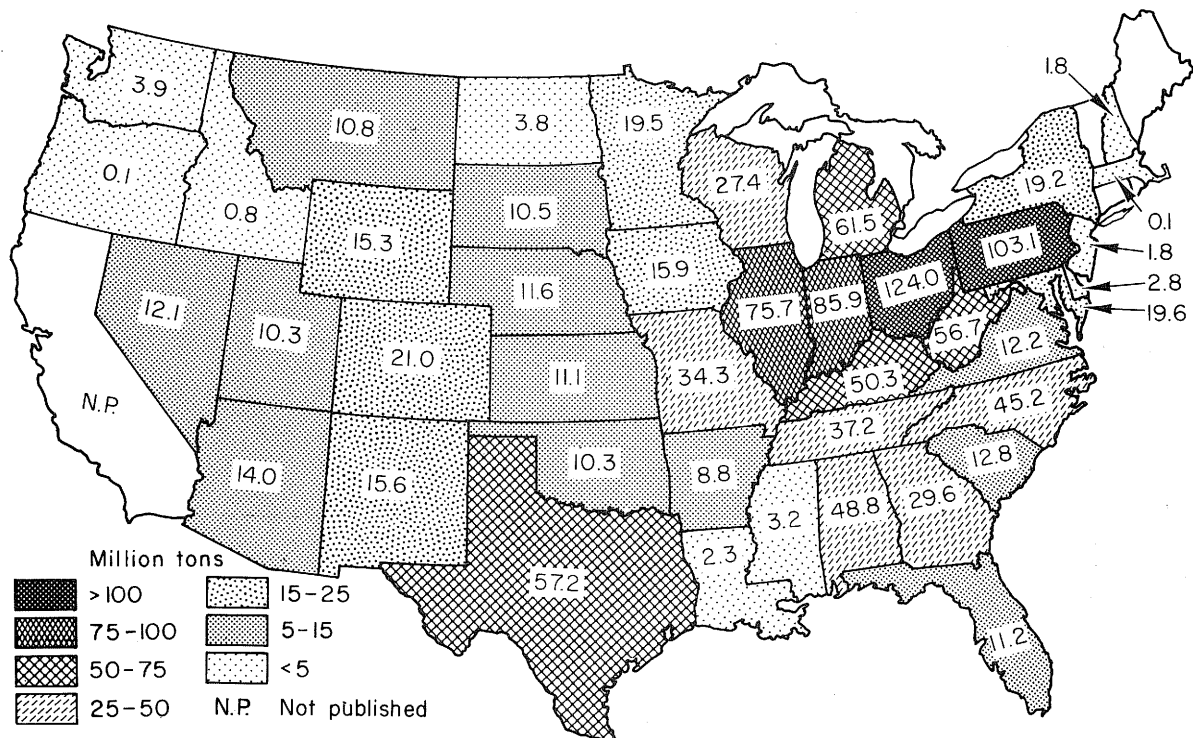


Fig. 6 - Projected demand for coal in the United States in 1985. (Source of data: Larwood and Benson, 1976.)

## FACTORS LIMITING ILLINOIS COAL DEVELOPMENT

In spite of the availability of enormous amounts of coal and the accessibility of that coal to principal coal-consuming regions, Illinois coal resources are lagging somewhat in development. As shown in figure 7, from 1961 until 1967 Illinois coal production was increasing at a rate somewhat higher than the national rate of growth in production. From 1967 through 1972, however, Illinois coal production showed essentially no growth. During the same period, United States production increased at an average rate of 2.1 percent per year. In the last four years, Illinois coal production has dropped from 65.5 million tons in 1972 to a low of 59.5 in 1975, while United States production has increased 7.4 percent from 595.4 million tons in 1972 to 640.0 million tons in 1975. The FEA estimates that while United States coal production will nearly have doubled from 1975 to 1985, Illinois production will have increased by only about 40 to 50 percent (Federal Energy Administration, 1974).

Let us examine some of the factors that seem to be limiting the development of Illinois coal resources. The first, which is primarily responsible for slow growth in Illinois coal development, is the Clean Air Act of 1970, which limits the use of high-sulfur coals. Since the act has been passed, low-sulfur coals have made deep inroads into the markets traditionally served by coals from the Illinois Basin (Illinois, western Kentucky, and Indiana). Electric utilities are the principal market served by Illinois coal. Figure 8 shows the sources of coal used by the electric utilities in various states. In 1966, as shown, a very limited amount of western coal was being used in the midwestern states, and more than half of the total coal consumed by electric utilities in Minnesota, Wisconsin, Iowa, Missouri, Illinois, Indiana, and Kentucky came from mines in the Illinois Basin. By the end of 1970, to meet the Clean Air Act requirements, several utilities in Minnesota, Iowa, Missouri, and Illinois were already shipping in low-sulfur coals from the western states (mainly Wyoming and Montana). According to the U.S. Bureau of Mines, in 1975 about 84 percent of the total coal used in Minnesota came from western states (fig. 9). Other states into which utilities imported substantial amounts of western coal for their use included Iowa (41 percent), Illinois (33 percent), Wisconsin (26 percent), Indiana (14 percent), Missouri (6 percent), and Michigan (5 percent). Western coals were also used in Kentucky and Ohio to produce electric power.

Another major market served by Illinois coal is industrial and manufacturing plants. Let us examine how the Clean Air Act has influenced the industrial market for Illinois coal. As figure 10 shows, in 1966 most of the coal used by industrial and manufacturing plants in midwestern states (Minnesota, Wisconsin, Iowa, Illinois, Indiana, Missouri, and Ken-

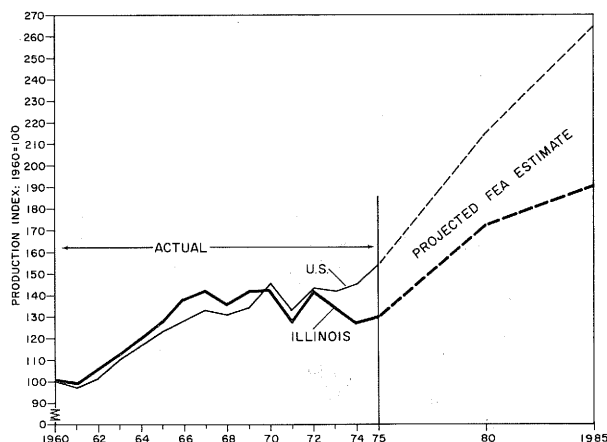


Fig. 7 - Coal production growth trend index.  
(Sources of data: FEA, 1974, and U.S. Bureau of Mines, 1960-1976.)



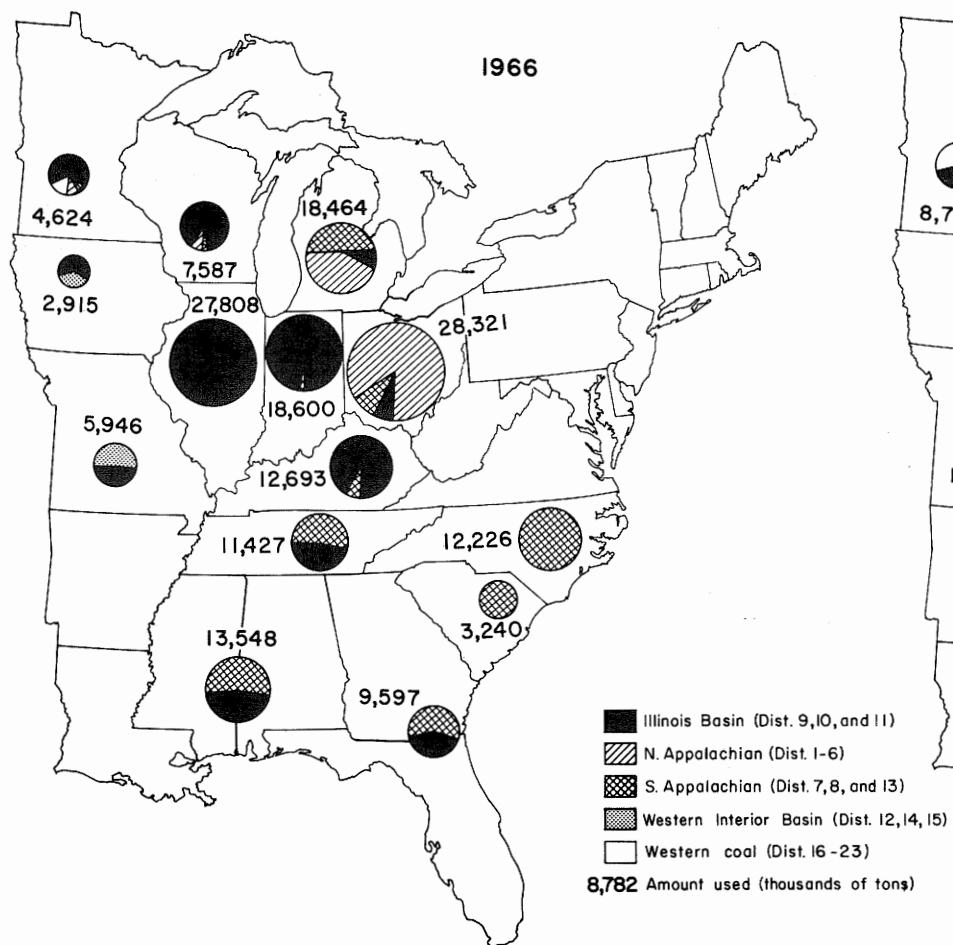


Fig. 8 - Coal consumption by electric utilities in selected states in 1966, by source of coal used. (Source of data: U.S. Bureau of Mines, 1967.)

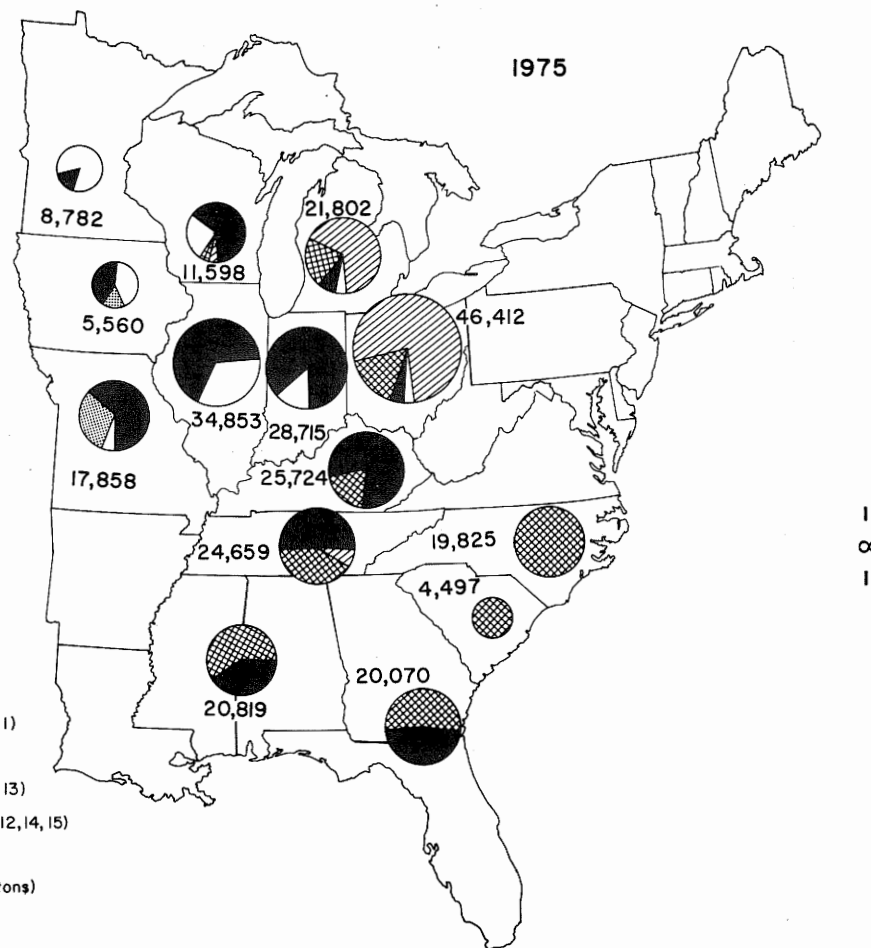


Fig. 9 - Coal consumption by electric utilities in selected states in 1975, by source of coal used. (Source of data: U.S. Bureau of Mines, 1976b.)

tucky) was shipped from mines located in the Illinois Basin (U.S. Bureau of Mines, 1967). Similar data for the year 1975 (fig. 11) show that in Minnesota the use of Illinois Basin coal has been totally replaced by western low-sulfur coals (U.S. Bureau of Mines, 1976b). In Wisconsin, Illinois, Indiana, and Kentucky, a substantial part of the industrial coal market has been lost to low-sulfur coals from western states and central Appalachian states.

The National Electric Reliability Council (1975) estimates that in 1984 about 86 percent of the total coal used in its MARCA region (which includes primarily the states of Minnesota, North Dakota, South Dakota, Iowa, and Nebraska) will be western coal (fig. 12). In the MAIN region, which includes Illinois and parts of Wisconsin and Missouri and which is the principal market region at present being served by Illinois coal, more than 37 percent of the total coal used would come from western states. In the SWPP region (fig. 12), which includes most of the south-central states, coal consumption is projected to increase to 8 times the present level and about 79 percent of the total coal is projected to come from western states. In the ECAR region, more than 20 million tons of western coal is projected to be used for the generation of electric power. This projected increase in the use of western coal, especially in areas traditionally served by Illinois coal, clearly shows that Illinois coal is likely to face a severe challenge from low-sulfur western coals.

Several utilities either have announced the installation of flue gas desulfurization systems or are seriously considering installing them (PEDCo-Environmental Specialists, Inc., 1976) (fig. 13). Unfortunately, disposal of waste resulting from flue gas desulfurization and, in many cases, reliability of the system are still major problems. We think that by 1980 some of the problems associated with the use of flue gas desulfurization systems will be resolved and therefore broader application of desulfurization technology (including retrofitting of existing plants) will be practical. The widespread use of flue gas desulfurization systems would help Illinois coal recover some of the market that has been lost to low-sulfur western coal. However, in the upper midwestern states (Michigan, Wisconsin, Iowa, and Minnesota) it appears that, despite the availability of desulfurization technology, the use of Illinois coal is likely to continue to decline as more low-cost western coals become available. As shown in table 1, the electric utilities in Michigan, Wisconsin, Iowa, and Minnesota are already paying 13 to 35 cents per million Btu less for western coal than for coal from Illinois mines. In Illinois, Indiana, and Missouri, which jointly consumed more than 70 percent of the total utility coal shipments from Illinois coal mines, the average price paid by the utilities in 1975 for Illinois coals was only 8 to 29 cents per million Btu less than for western coals. This differential in price suggests that, in order to regain midwestern coal markets, not only does low-cost desulfurization technology need to be developed, but a substantial improvement in Illinois coal mine productivity will have to be achieved in order to lower costs.

The second factor that is to some extent responsible for slow growth in Illinois coal development is competition from nuclear power. In table 2, the comparison of costs for power plants by type of fuel is shown. The data show that the operation of nuclear power plants is about 17 percent less costly than the operation of coal plants. Largely because of this difference, several

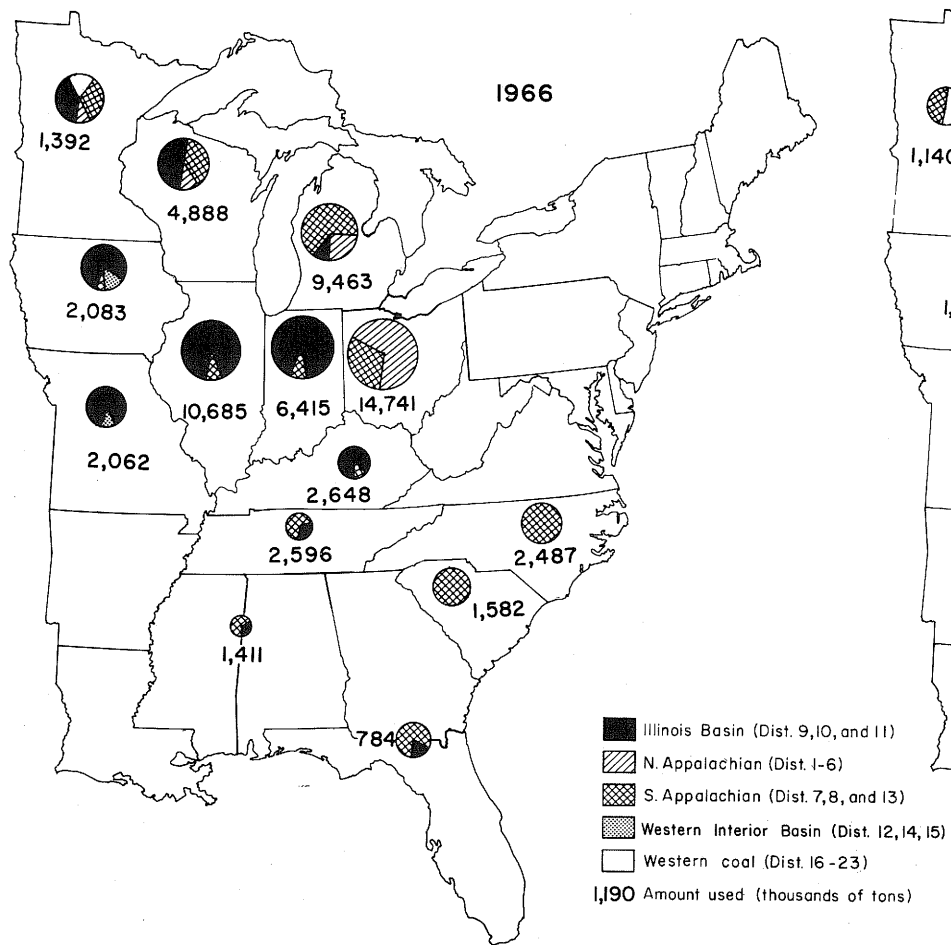


Fig. 10 - Coal consumption by industry in selected states in 1966, by source of coal used. (Source of data: U.S. Bureau of Mines, 1967.)

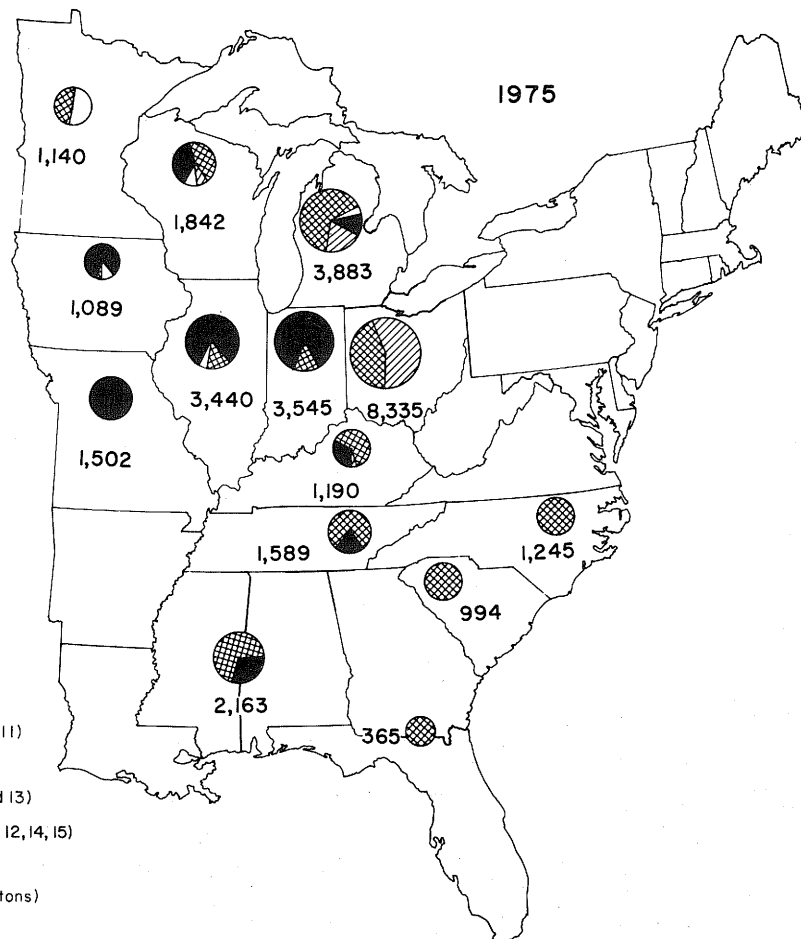


Fig. 11 - Coal consumption by industrial plants in selected states in 1975, by source of coal used. (Source of data: U.S. Bureau of Mines, 1976b.)

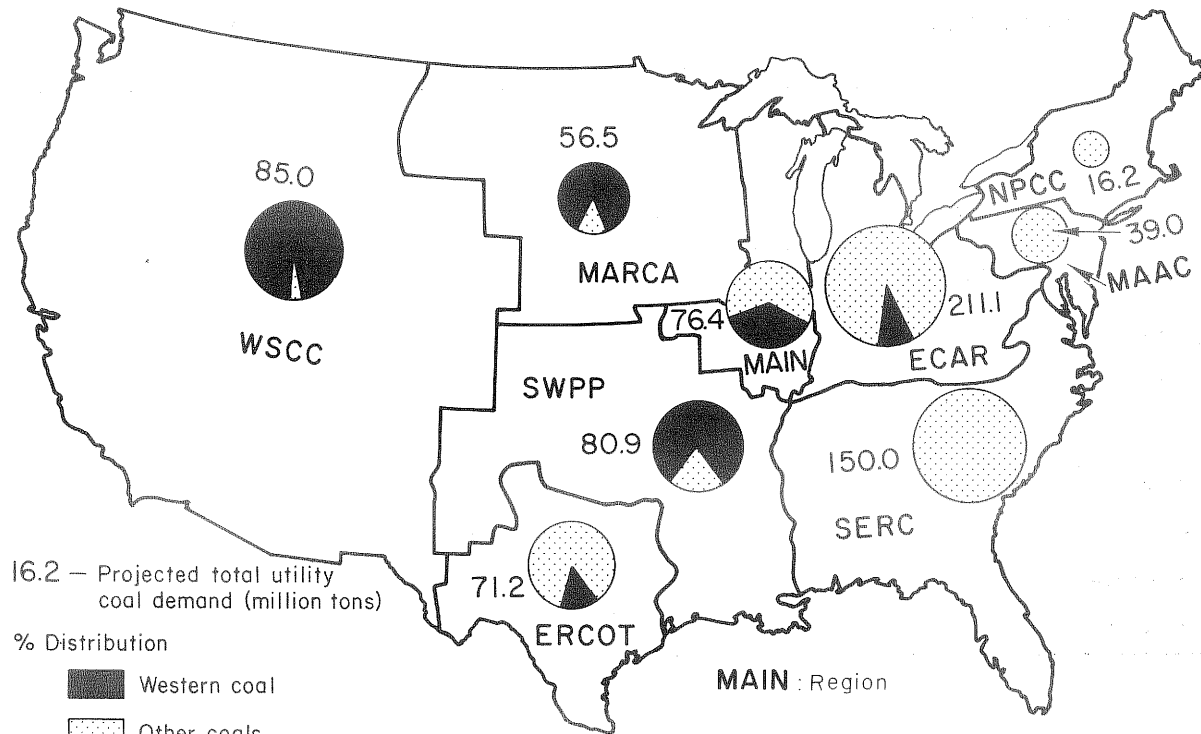


Fig. 12 - Projected use of western coal by electric utilities in the United States in 1984. (Source of data: National Electric Reliability Council, 1975.)

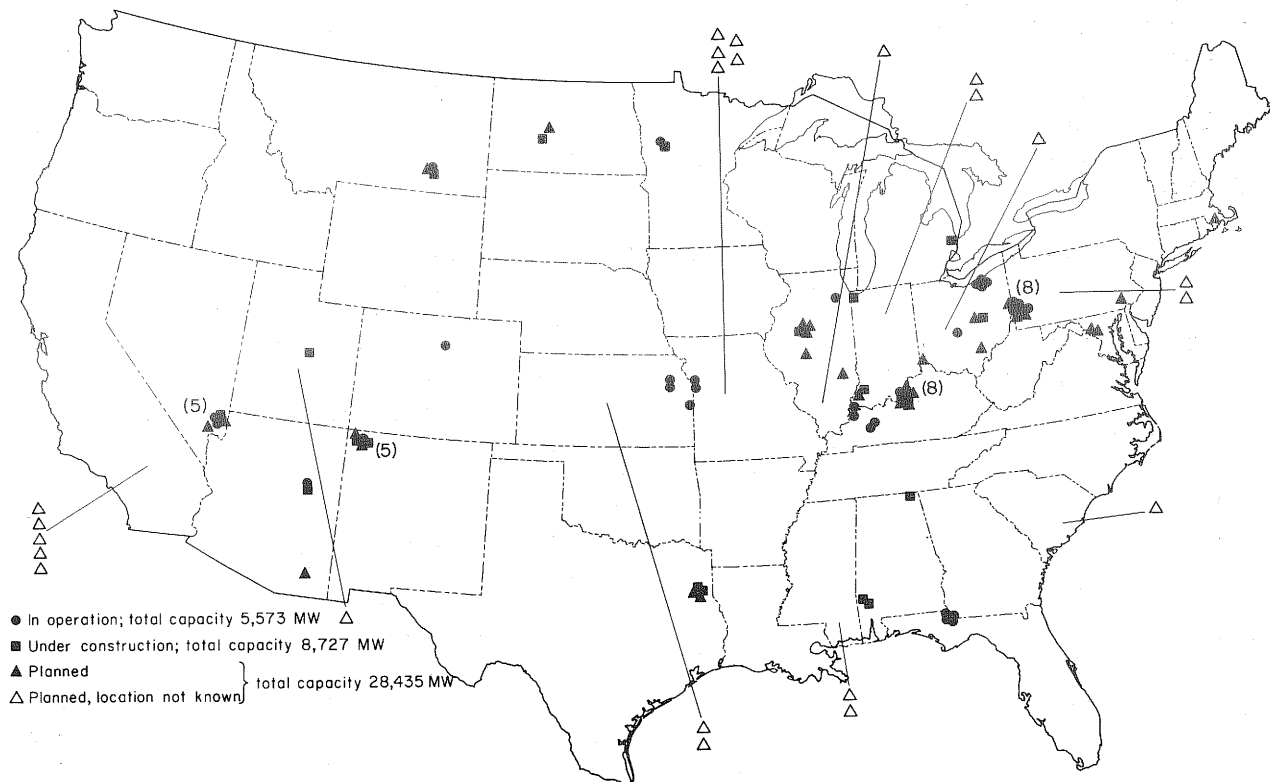


Fig. 13 - Flue gas desulfurization systems operating, under construction, or planned in the United States, July 1976. (Source of data: PEDCo-Environmental Specialists, Inc., 1976.)

TABLE 1—AVERAGE PRICE PAID BY ELECTRIC UTILITIES FOR COAL  
FROM SELECTED STATES—1975

State	Tons delivered (x1000)	Price paid for coal (\$/million Btu)			Difference (1) - (2) =	Difference (1) - (3) =
		(1) Illinois coal	(2) Wyoming coal	(3) Montana coal		
Illinois	21,218.1	0.66	0.77	0.95	-0.11	-0.29
Indiana	3,134.6	0.69	0.77	0.92	-0.08	-0.23
Michigan	274.5	1.21	—	0.86	—	+0.35
Wisconsin	4,856.9	0.87	0.69	0.62	+0.18	+0.25
Iowa	2,518.5	0.87	0.74	0.88	+0.13	-0.01
Minnesota	1,717.3	0.77	—	0.56	—	+0.21
Missouri	10,661.1	0.53	0.61	—	-0.08	—

Source of data: Federal Power Commission (1976).

electric utilities in the United States are contemplating further construction of nuclear power plants. As shown in figure 14, it has been projected that, by the end of 1984, about 30 percent of the total electric power generation in the MAIN, SERC, MAAC, and NPCC regions will come from nuclear power. Within the MAIN region, where there are enormous coal reserves, the proportion of total electric energy derived from coal is projected to decline from 60 percent in 1975 to 56 percent in 1984. During the same period the use of nuclear power is projected to increase from 17.0 percent in 1975 to 29.3 percent in 1984 (National Electric Reliability Council, 1975).

Slow progress in the development of technology to produce synthetic fuels from coal is also a factor that is to some extent holding back the development of Illinois coal resources.

TABLE 2—BASELOAD ELECTRICITY  
GENERATION COSTS\*  
(mills/kWh, 1975 dollars)

	<u>Nuclear</u>	<u>Coal</u>	<u>Oil steam</u>
Capital	13.45	9.30	7.58
Fuel	1.80	10.11	20.70
Other	<u>3.00</u>	<u>2.00</u>	<u>1.88</u>
Total	18.25	21.41	30.16

\*Assumes a delivered price of \$1.10 per million Btu for low-sulfur coal and \$2.25 per million Btu for residual oil. Capital costs in 1975 dollars are \$550 per kW for nuclear, \$380 per kW for coal, and \$310 per kW for oil. A fixed charge rate of 15 percent and a capacity factor of 0.7 were assumed. Source of table: Federal Energy Administration (1976).

There are several major mining companies that have acquired coal reserves in Illinois for the production of synthetic fuels. These companies, along with other major owners of Illinois coal reserves, are closely watching developments in the production of synthetic fuel. ERDA (Energy Research and Development Administration) has recently announced that a \$237 million demonstration plant that will produce 3,900 barrels of liquid fuels per day and 22 million cubic feet of gas per day will be constructed in Illinois. Construction of the plant is scheduled to be completed by the end of 1980.

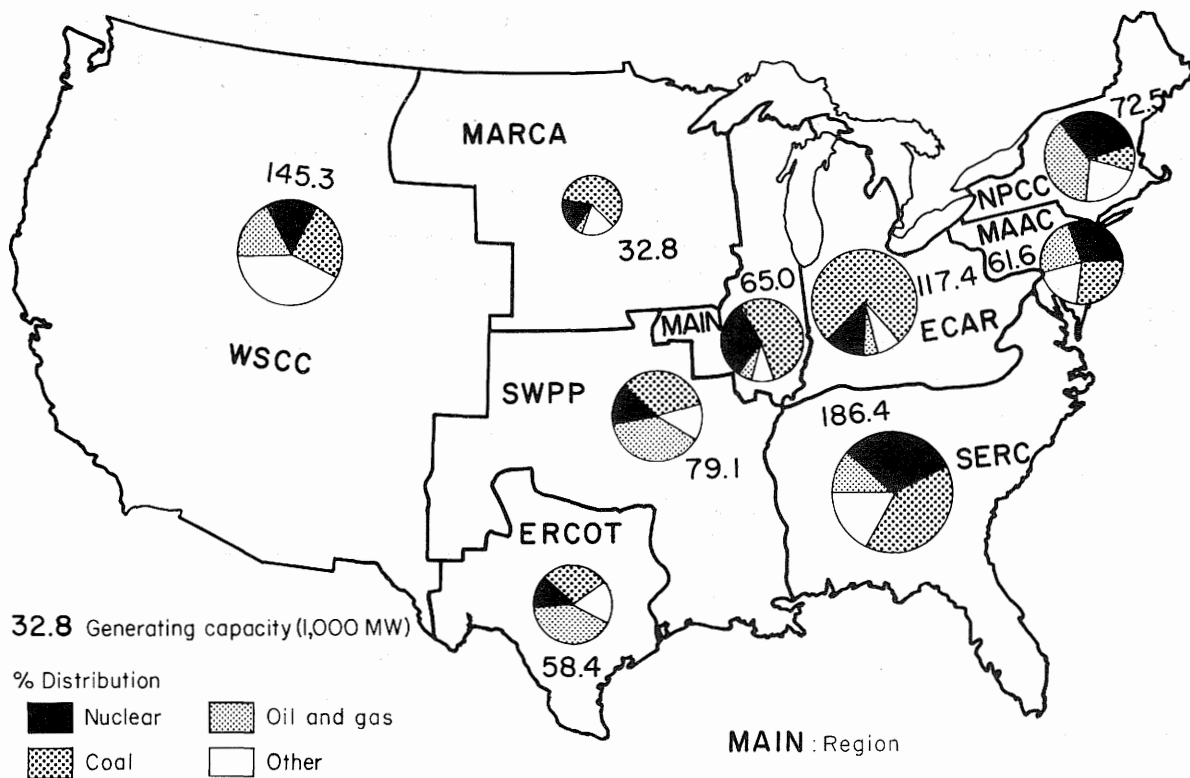


Fig. 14 - Projected electric power generating capacity in 1984, by type of fuel. (Source of data: National Electric Reliability Council, 1975.)

The plant, to be located at New Athens, will be operated by Coalcon to evaluate the efficiency of design of the plant and the marketability of the plant's products. ERDA has also announced the approval of planning funds for a demonstration plant that will cost between \$200 million and \$400 million and will gasify 2,200 tons of coal per day to produce 18 million cubic feet of gas per day and 2,400 bbl of synthetic crude oil per day. The plant will be in Perry County and will be operated by the Illinois Coal Gasification Group, which includes Peoples Gas Light and Coke Co., Northern Illinois Gas Co., Central Illinois Light Co., Central Illinois Public Service Co., and North Shore Gas Co. Even though industry and federal and state governments are making considerable efforts to demonstrate and commercialize technology for the production of synthetic fuel from coal, we believe that commercialization of synthetic fuels is not likely to begin much before 1985 and that, after that beginning, a number of years will pass before synthetic fuels make a significant contribution to total energy needs. The impact of synthetic-fuel production on Illinois coal, however, should be significant in a shorter time.

Federal, state, and local government regulations of coal mining are also factors which in some cases limit or delay the development of coal reserves.

The lack of a positive national policy encouraging the utilization of coal is also a factor which limits the development of new mines in Illinois and elsewhere in the United States.

# PROJECTED COAL SUPPLY FROM ILLINOIS MINES

In spite of the problems Illinois coal currently faces, there are some regions where it is still competitive with other fuels. To supply coal to these markets, the industry has announced plans for the opening of 12 new mines and the expansion of 2 existing mines in Illinois (Nielsen, 1976). The opening of several other mines in Illinois is also being seriously considered. Let us examine the quantity of coal that is likely to be produced from coal mines in Illinois to meet the needs of the near future (table 3).

## Short-Term Outlook—1977

In 1975, Illinois coal production totaled 59.5 million tons and the number of days that all mines worked averaged 205 days, according to the Illinois Department of Mines and Minerals (1976). To estimate mining capacity of mines, the U.S. Bureau of Mines assumes 235 working days per year as a limit. Illinois mine data show that, except in 1967, the average number of days per year worked at all mines in Illinois has never exceeded 235 days. In the past 10 years (except possibly in 1967), the average number of days that all mines worked has ranged from 184 to 220 days. Assuming 235 days as the highest attainable figure, we estimate Illinois coal mining capacity at present to be about 68 million tons. The 8-month Illinois mining production record (January through August, 1976) suggests that Illinois coal production in 1976 may be about the same as it was in 1975, if not below. Several new mines are expected to start production in 1977, and with the production from these new mines, Illinois coal production in 1977 may range from 60 to 65 million tons.

According to a U.S. Bureau of Mines projection for 1977, Illinois coal production will increase to 71 million tons (U.S. Bureau of Mines, 1974). In the FEA's Project Independence Report, Illinois coal production was estimated to reach a level of 73.2 million tons by 1977 (Federal Energy Administration, 1974). In our opinion both of these forecasts are too optimistic to be achieved by next year.

TABLE 3—PROJECTED COAL SUPPLY  
FROM ILLINOIS MINES  
(million tons)

<u>Short-Term Outlook—1977</u>	
U.S. Bureau of Mines . . . . .	71.0
Federal Energy Administration. . . . .	73.2
Illinois State Geological Survey . . . . .	60-65
<u>Intermediate-Term Outlook—1980</u>	
Based on <u>Coal Age</u> capacity forecast. . . . .	77.4
U.S. Bureau of Mines . . . . .	75.0
Federal Energy Administration	
BAU— <u>business as usual scenario</u> . . . . .	79.0
ACC— <u>accelerated development scenario</u> . . . . .	112.0
Illinois State Geological Survey . . . . .	77-80
<u>Long-Term Outlook—1985</u>	
Based on NCA's capacity forecast . . . . .	82.0
Federal Energy Administration	
BAU— <u>business as usual scenario</u> . . . . .	87.7
ACC— <u>accelerated development scenario</u> . . . . .	165.4
Illinois State Geological Survey	
Growth rate 1980-1985: 1.5 percent per year . . .	82.5
Growth rate 1980-1985: 4.0 percent per year . . .	93.1
Growth rate 1980-1985: 8.0 percent per year . . .	112.1
Sources of data: U.S. Bureau of Mines (1974a); Federal Energy Administration (1974); <u>Coal Age</u> (Nielsen, 1976); National Coal Association ( <u>Coal News</u> , 1975); and Illinois State Geological Survey.	

### Intermediate-Term Outlook—1980

Within the next five years several new mines are expected to reach full capacity, bringing a substantial increase in Illinois coal mining capacity. The February 1976 issue of *Coal Age* reported plans for the opening of 12 new mines and the expansion of 2 existing mines in Illinois by 1980 (Nielsen, 1976). *Coal Age* estimates that, when all of these announced new mines and mine expansions are completed, the new capacity will amount to about 33 million tons. Considering a capacity loss resulting from mines closing at the rate of 5 percent per year, as estimated by the FEA (1974) on a national basis, the existing Illinois mine capacity of 68 million tons per year would be reduced to 53 million tons per year by 1980; the net increase in capacity resulting from the additional capacity would increase the existing mine capacity by 26 percent, to 86 million tons per year. At a 90 percent capacity-utilization rate, in 1980 Illinois coal production would amount to about 77 million tons.

In 1974 the U.S. Bureau of Mines estimated that 1975 Illinois coal production would be 68 million tons (U.S. Bureau of Mines, 1974). In 1975, however, actual production in Illinois was only 59.5 million tons. The 1974 U.S. Bureau of Mines report further estimated that Illinois coal production would reach a level of 75 million tons by 1980. This estimate is only 2 million tons short of the production level that we estimated from the *Coal Age* forecast (Nielsen, 1976).

In the FEA Project Independence Report, the FEA Coal Task Force estimated the future coal supply from various coal-producing regions under two scenarios—*business as usual scenario* and *accelerated development scenario*. The Task Force estimated that, under a *business as usual scenario*, in 1980 Illinois coal production would amount to 79.0 million tons (Federal Energy Administration, 1974).

We arrived at a similar coal production estimate using the following approach:

1. *Coal Age*'s new mine capacity estimate was adjusted to allow for mines that we considered not likely to reach full capacity by 1980.
2. The existing mine capacity, 68 million tons per year, was adjusted to allow for mine depletion losses that we estimated by assuming that all the mines which are now more than 30 years old will not be in operation in 1980.
3. Existing mine capacity was also adjusted for capacity losses that are likely to result from premature shut-down of less efficient mines.

We estimate the total new capacity that is likely to be added between now and 1980 at about 27 million tons. Of this amount about 9 million tons would be replacement capacity; therefore, the total net capacity that may be added between now and 1980 would amount to 18 million tons, bringing Illinois



coal mining capacity in 1980 to about 86 million tons per year. At a 90 percent capacity-utilization rate, Illinois coal production in 1980 would be about 77 million tons. Since construction of two coal-conversion demonstration plants is scheduled to be completed by 1980, the need for an additional 2 to 3 million tons of coal per year could easily arise, bringing Illinois coal production to about 80 million tons. All the forecasts considered here lead to the conclusion that in 1980 Illinois coal production is most likely to fall between 75 and 80 million tons.

#### Long-Term Outlook—1985

The actual tonnage that will be produced from mines in Illinois in 1985 is likely to be influenced by the effects of several factors, including: amendments to the Clean Air Act, if there are any; development of western coal and the ability of this coal to intrude upon the markets traditionally served by Illinois coal; public acceptance of nuclear power to generate electricity; magnitude of the projected shortfall in supply of competitive fuels, especially natural gas; and federal, state, and local governmental policies regulating the mining and utilization of coal.

To project the supply of coal from Illinois mines in 1985, we assumed three demand growth rates for Illinois coal for the period 1980-1985—low, medium, and high (fig. 15). The low demand growth rate assumed—1.5 percent per year—is similar to the growth rate that the Illinois Basin coal industry experienced from 1950 through 1960, when increased use of natural gas and fuel oil essentially wiped out potential new coal markets. Conditions that we believe could lead to a low growth rate would be: severe competition from western coals; a further shrinkage in high-sulfur coal markets as a result of tough environmental regulations and lack of adequate desulfurization technology; continuing competition of natural gas and fuel oil with coal; a further increase in competition from nuclear power; and a slower than projected overall increase in demand for coals.

The medium demand growth rate for Illinois coal assumed for the period 1980-1985—4 percent per year—is slightly below the rate under which the Illinois Basin coal industry expanded from 1960 through 1969, when the demand for utility coal increased at an average growth rate of about 7 percent per year. Conditions that we believe could once again lead to this growth rate include: an increase in the use of Illinois coal in Illinois, Indiana, Kentucky, and Missouri; the increased use of flue gas desulfurization technology to remove sulfur and hence open some coal markets that are now considered lost to western coals; limitations on the amount of coal available from regions that traditionally supplied southeastern states and a consequent need to ship larger amounts of coal from the Illinois Basin, and in particular from Illinois, to these states; growth in the use of Illinois coal in both the industrial and the coking markets; limited availability, high prices, and governmental regulations continuing to discourage manufacturing plants and utilities from using natural gas; and efforts by federal and state governments to promote legislation encouraging the coal mining industry to supply coal to meet national needs.

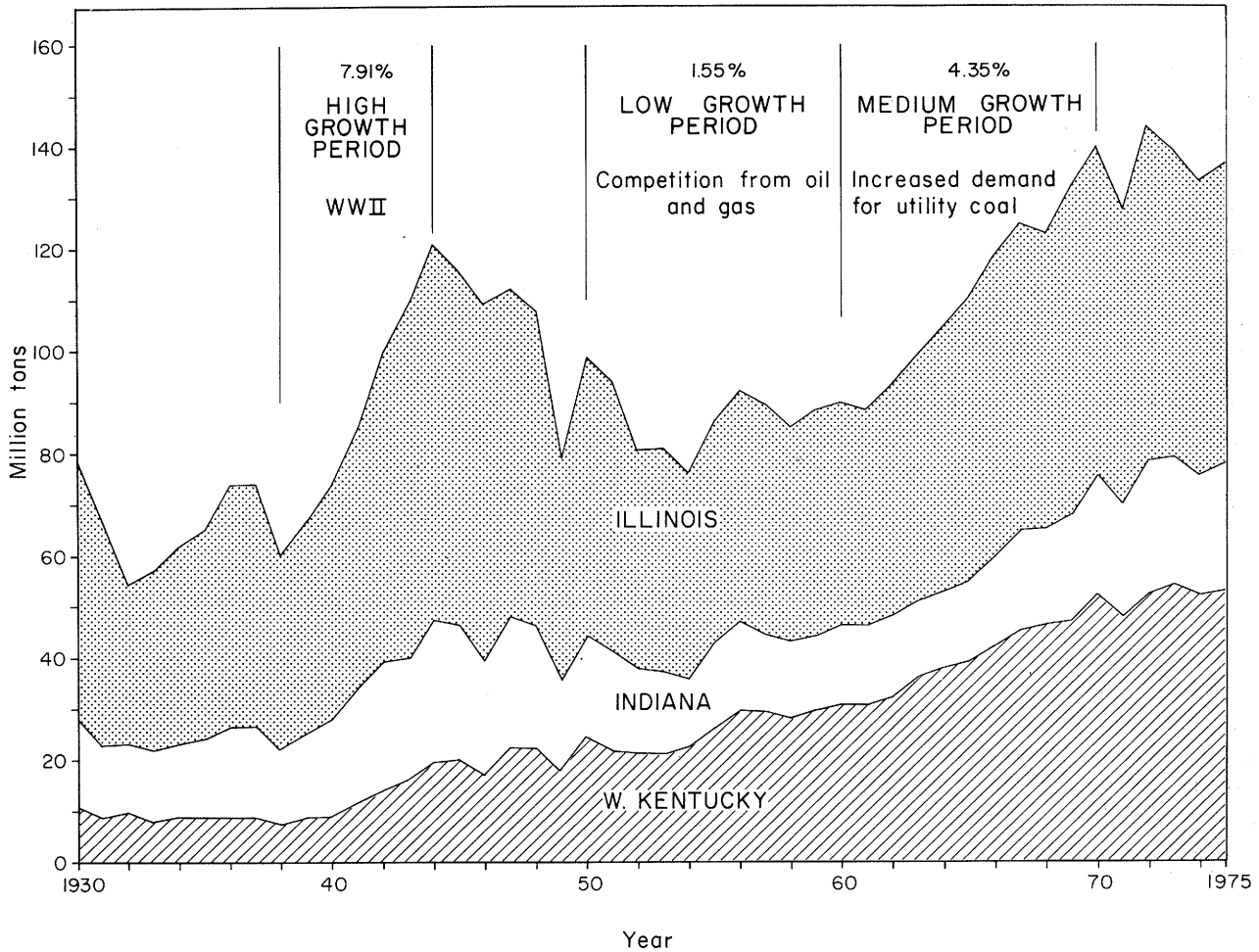


Fig. 15 - Trends in coal supply from the Illinois Basin, 1930-1975.

A high demand growth rate from 1980 to 1985—8 percent per year—would correspond to the rate that the Illinois Basin industry experienced during World War II. The following conditions could contribute to this rate: a drastic slowdown in the development of western coal fields; strict limitations imposed on the use of nuclear power to generate electricity; reduced availability of fuel oil and natural gas; an easing of the limitations imposed on the use of high-sulfur coals; expanded use of Illinois coal for synthetic-fuel production; and the adoption of government policy favoring the use of coal.

If from 1980 to 1985 the demand for Illinois coal increases at an average growth rate of 1.5 percent per year, we estimate that Illinois coal production in 1985 will have to increase to about 83 million tons, slightly more than the amount estimated to be produced in 1980. If the demand for coal increases at a growth rate of 8 percent per year from 1980 to 1985, however, the productive capacity of Illinois coal mines will have to be expanded substantially to produce more than 112 million tons. If the Illinois coal demand increases at an average growth rate of 4 percent per year from 1980 through 1985—and we think that this is a likely rate—Illinois coal mine productive capacity will have to be expanded to produce more than 93 million tons of coal in 1985.

The National Coal Association has made a survey of plans that the United States coal industry is considering regarding expansion of present mine capacity through the opening of new mines or the expansion of existing mines (Coal News, 1975). For Illinois the survey shows that between now and 1985 the industry plans to develop an additional capacity amounting to 41 million tons. Obviously, part of this new capacity would be required to replace depletion of existing mines. The FEA (1974) used depletion rates of 5 percent per year through 1980 and 3 percent per year thereafter. Using these rates of depletion, we estimate that by 1985 about 23 million tons of the existing 68 million ton capacity will be lost owing to depletion. Thus the net Illinois coal mining capacity in 1985 would be about 86 million tons. Even at a 95 percent capacity-utilization rate, the production from Illinois coal mines in 1985 would be only 82 million tons—about 11 million tons less than the amount we think would be needed at a 4 percent growth rate and about 30 million tons less than the amount estimated to be needed if demand for Illinois coal increased at the rate of 8 percent per year from 1980 through 1985.

In the FEA's Project Independence Report (Federal Energy Administration, 1974), the Coal Task Force estimated that in 1985 Illinois coal production would reach a level of 87.7 million tons under a *business as usual scenario* and as high as 165.4 million tons under an *accelerated development scenario*. In a more recent report (Federal Energy Administration, 1976), these production forecasts have been somewhat curtailed. In view of our forecast, it is clear that the coal supply projected under the original FEA *business as usual scenario* for Illinois would not even be enough to meet the projected demand. This suggests that several new mines, in addition to ones already announced or being planned, may have to be opened in Illinois between 1980 and 1985 to meet the demand.

## CONCLUSIONS

Despite the problems facing the coal industry in Illinois, the use of Illinois coal is bound to increase. Although the increase in the use of Illinois coal is not likely to be as high as the increase projected for the use of western coals, Illinois coal is expected to continue to supply a substantial portion of the coal used in the United States. In view of our prediction of a 4 percent rate of growth, we believe that the industry's announced capacity for 1985 will not be adequate to meet the demand. Therefore, we feel that it will be necessary to open several new mines between 1980 and 1985, in addition to those announced or being planned, to bring Illinois coal mining capacity to more than 102 million tons per year, which at a 90 percent effective utilization could supply the 93 million tons of coal that we estimate will be needed in 1985. If the development of western coal is considerably slowed down and the limitations imposed on the use of high-sulfur coals are eased, the demand for Illinois coal could increase substantially, and to supply this demand, Illinois coal mining capacity by 1985 may even have to be almost doubled from the 1975 estimated mining capacity of about 68 million tons.

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