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General Accounting Office

Prospects For Long-Term U.S. Steam Coal Exports To European And Pacific Rim Markets

U.S. exports of coal used for electricity generation and industrial heating are expected to increase in volume over the long term, but they probably will remain a small portion of total U.S. coal production.

Other countries have much lower production and delivery costs and could underprice U.S. exporters by significant margins but choose to price their coal only marginally below U.S. prices to maximize their profits. Therefore, the U.S. market share will be subject to the pricing strategies of major competitors.

GAO/NSIAD-83-08
AUGUST 4, 1983

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UNITED STATES GENERAL ACCOUNTING OFFICE
WASHINGTON, D.C. 20548

NATIONAL SECURITY AND
INTERNATIONAL AFFAIRS DIVISION

B-203675

The Honorable Edward J. Markey
Chairman, Subcommittee on
Oversight and Investigation
Committee on Interior and
Insular Affairs
House of Representatives

Dear Mr. Chairman:

This report addresses the future overseas demand for steam coal, the U.S. position in the overseas markets, and potential barriers to growth in U.S. steam coal exports. It was prepared in response to your request that we review the prospects for U.S. steam coal exports to European and Pacific Rim markets.

As arranged with your office, no further distribution of this report will be made for 10 days from the date of issue unless you publicly announce its contents earlier.

Sincerely yours,

Bill W. Thurman

for Frank C. Conahan
Director

REPORT BY THE U.S. GENERAL ACCOUNTING OFFICE

PROSPECTS FOR LONG-TERM U.S. STEAM COAL EXPORTS TO EUROPEAN AND PACIFIC RIM MARKETS

D I G E S T

At the request of the Chairman, Subcommittee on Oversight and Investigations, House Committee on Interior and Insular Affairs, GAO reviewed the competitiveness and long-term prospects for U.S. steam coal exports to European and Pacific Rim markets. Steam coal is used for electricity generation and industrial heating.

Although U.S. steam coal exports are expected to increase in volume over the long term, they probably will remain a small portion of total U.S. coal production.

The recent U.S. steam coal export boom, which peaked in mid-1982, was largely attributable to supply disruptions in other major coal exporting countries. U.S. exports began to decline as Poland and Australia entered the market after extended strikes.

The United States is the high-cost supplier of steam coal in both the European and Pacific Rim markets. South Africa and Australia have much lower production and delivery costs and could underprice U.S. exporters by significant margins but choose to price their coal only marginally below U.S. prices to maximize their profits. Poland, a centrally planned economy, bases the prices of its coal exports on its need to obtain foreign hard currency. The U.S. share of international steam coal markets, therefore, depends largely upon the market strategies of its major competitors--South Africa and Poland in Europe and Australia in the Pacific.

The cost of producing and delivering the coal to the foreign market is the primary barrier to increasing U.S. coal exports. Production, port, and inland transportation capacities appear adequate to handle current and projected export levels.

Tear Sheet

GAO/NSIAD-83-08

AUGUST 4, 1983

AGENCY COMMENTS

GAO did not seek agency comments, but officials from the Departments of Energy and State, the Army Corps of Engineers, and the Appalachian Regional Commission reviewed a draft of this report and generally agreed with its content.

Contents

ABBREVIATIONS

Dwt	dead weight tons
EEC	European Economic Commission
GAO	General Accounting Office
ICC	Interstate Commerce Commission
IEA	International Energy Agency
mmt	million metric tons
OECD	Organization for Economic Cooperation and Development

CHAPTER 1

INTRODUCTION

This report assesses the present and prospective U.S. position in the steam coal[1] markets of Europe and Pacific Rim countries,[2] taking into account the potential barriers to U.S. coal exports.

For decades, international coal trade largely involved coal used for steel production--commonly called metallurgical (met) or coking coal.[3] Until recently, steam coal represented only about 25 percent of world coal trade. With the oil embargo of 1973 and the steep increase in oil prices, steam coal began to be considered as an important fuel with the potential for substantial growth in world energy use. The abrupt oil price increase in 1979 accelerated the growth in U.S. steam coal exports.

The surge in demand for U.S. steam coal during 1979-82 resulted from sudden shifts in the world steam coal supply pattern at the same time that demand began to significantly increase. Extended strikes had disrupted production of Poland and Australia, two of the primary suppliers of coal to Europe and the Pacific Rim, so European and Pacific buyers turned to the United States. Demand also increased as buyers built stockpiles in anticipation of a miner strike in the United States, which did occur from March 27 to June 8, 1981.

The sudden increased demand for U.S. steam coal caused rail transportation problems (scheduling deliveries to ports and extended turn-around times for coal cars) and congestion in the traditional east coast coal ports of Hampton Roads and Baltimore. At one point, 152 coal ships were waiting to enter Hampton Roads harbor. As the ships waited, they incurred charges

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[1]Coal used to produce steam for electricity generation or for heat in industrial processes is commonly called steam or thermal coal.

[2]The European market includes Austria, Belgium, Denmark, West Germany, Greece, France, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, and the United Kingdom. The Pacific Rim market consists principally of Japan, Taiwan, and South Korea, but it also includes Hong Kong, the Philippines, Singapore, Thailand, and Malaysia.

[3]Only bituminous coal of certain characteristics is used to make coke. All ranks of coal (anthracite, bituminous, sub-bituminous, and lignite) are used as steam coal; however, anthracite is scarce and lignite is not economical to transport long distances, so bituminous and sub-bituminous coal account for most steam coal and all met coal trade.

for detention beyond the time allowed for loading, known as demurrage charges, of as much as $20,000 per day per ship; one coal trader said that demurrage charges on one shipload alone were $1.9 million. Foreign buyers complained bitterly about the high demurrage and the resulting increase in the delivered cost of the coal.

As shown in table 1, despite these problems U.S. steam coal exports increased, particularly to countries other than Canada; however, they remain a relatively small percent of total production.

Table 1

U.S. Bituminous Coal Exports
(millions of short tons)

	Total Exports				Exports, excluding those to Canada			
	Met	Steam	Total	Percent of total production	Met	Steam	Total	Percent of total production
1975	51.6	14.1	65.7	10.5	44.4	4.6	49.0	7.8
1976	47.8	11.6	59.4	9.1	40.5	2.4	42.9	6.6
1977	41.9	11.8	53.7	8.1	35.3	1.2	36.5	5.5
1978	30.3	9.6	39.9	6.5	24.3	0.3	24.6	4.0
1979	50.7	14.1	64.8	10.4	43.1	2.5	45.6	7.3
1980	63.1	26.8	89.9	11.5	56.8	16.0	72.8	9.3
1981	65.2	45.0	110.2	14.3	59.4	33.0	92.4	12.0
1982	64.6	40.7	105.3	13.7	59.7	27.4	87.1	11.3
1983[a]	56.0	36.0	92.0	11.9	50.0	25.0	75.0	9.7

[a]Projections.

Source: Export data from Bureau of Census (1975-83) and National Coal Association (1983). Production data from National Coal Association (1975-79 and 1983) and Energy Information (1980-82).

In 1982, because of the worldwide economic recession, resumption of Polish and Australian exports, and the rise in the value of the U.S. dollar against most other currencies, the demand for U.S. steam coal slackened.

NATURE OF U.S. STEAM COAL EXPORT MARKET

The United States (1) is geographically situated to serve both the European and Pacific markets, (2) produces coal from four distinct regions, (3) exports from four widely separated coasts--east and west coasts, Gulf of Mexico, and Great Lakes through the St. Lawrence Seaway, and (4) has the largest export volume of any producer but exports a rather small percent of total production.

Market areas

The United States exports steam coal to three distinct major markets--Europe, Canada, and the Pacific Rim--and some other minor markets, as shown in appendix I.

Eastern Canada was the largest market until 1980. Canadian imports of U.S. steam coal follow a long-established pattern and have remained fairly stable during the 1970s and even during the surge of 1980 and 1981.

Western Europe was the second largest market until 1980, when it surpassed Canada. France is currently the largest European importer of U.S. steam coal.

The Pacific Rim is the third largest market. Japan is the major importer in this market, followed by Taiwan and South Korea.

Production and transportation

Coal is produced in roughly four major areas within the United States, each with distinct problems and patterns of production and transportation: (1) Appalachia, (2) Midwest, (3) West, and (4) Alaska. The Appalachian area accounted for nearly 90 percent of U.S. steam coal exports in 1981.

Most export coal is moved to ports by railroad. The distance from mine to port makes truck movement uneconomical in most cases. Where inland waterways exist, barges are used.

Appalachian coal is exported through several ports on the east, Gulf, and Great Lakes coasts. Major east coast ports are Hampton Roads (which includes the ports of Norfolk, Newport News, and Portsmouth), Baltimore, and Philadelphia.

Nearly all coal exported to Canada and some coal going overseas from both northern Appalachia and the Midwest is shipped from the Great Lakes ports on laker vessels. Coal for overseas destinations is carried on laker vessels through the St. Lawrence Seaway to the Gulf of St. Lawrence, where it is transferred to deep-water ships for overseas shipment.

Some mines in Southern Appalachia and the Midwest export coal through the New Orleans port. Coal from Southern Appalachia also moves through Mobile. Most of the coal exported from the New Orleans port reaches the port via river barge, although some has moved by train. Western coal can also move to Europe through Gulf ports.

Most coal exported from mines in Montana, Wyoming, Colorado, Utah, and New Mexico moves by rail to the ports of Los Angeles and Long Beach on the west coast, which are served by four railroads. Inland transportation accounts for 50 to 75 percent of the delivered cost of western coal at the port.

COMPARISON OF U.S. COAL INDUSTRY WITH THAT OF MAJOR COMPETITORS

The U.S. coal industry is organized and functions differently from its major competitors in several key respects.

--Export coal constitutes only a minor share of total U.S. coal production, whereas it is a major share of production for foreign competitors.

--Foreign coal production is dominated by a handful of large producers with large mines. U.S. production, especially in Appalachia, involves many producers, ranging from large multinational corporations to small companies.

--Most foreign production is tied to long-term contracts. Foreign competitors have little excess developed capacity and provide little production for spot market sales.

--The spot market is well established in the United States, especially in Appalachia, and U.S. producers have considerable excess production capacity.

--Most of the new, high-volume mines, railroad networks, and port facilities of Australia, South Africa, and Western Canada are government-owned and operated and have been designed expressly for large-scale exports of steam coal. U.S. railroads and ports were developed more for general commerce and metallurgical coal export trade and around the diverse U.S. coal industry, particularly in Appalachia.

OBJECTIVES, SCOPE, AND METHODOLOGY

This review is limited to steam coal, although some data on metallurgical coal is provided for perspective. It focuses primarily on the potential for future U.S. steam coal exports to

the European and Pacific Rim markets and the U.S. ability to meet potential market demands and compete effectively with other coal exporting nations. The review also discusses the various factors and events that may affect future demand for steam coal and U.S. competitiveness in the world market.

In addition to reviewing numerous studies and reports issued in recent years, we obtained information in the United States from the:

--Departments of Commerce, Energy, and State; Maritime Administration; Army Corps of Engineers; and Interstate Commerce Commission.

--National Coal and Coal Exporters Associations and 25 coal producers, traders, or exporters.

--Association of American Railroads, Slurry Transportation Association, and officials of 8 U.S. railroads.

--American Associates of Port Authorities and officials from 32 U.S. ports.

--Appalachian Regional Commission.

To obtain the foreign perspective on potential overseas markets and future steam coal demand, we interviewed and obtained information from government officials and coal industry representatives in Belgium, Denmark, France, Germany, Italy, the Netherlands, Japan, Korea, and Taiwan. We also obtained information from the Industrial Bank of Japan, New Energy Development Organization, Center for Cultural and Technical Interchange Between East and West (East-West Center), Institute of Energy Economics in Japan, Commission of the European Communities, Organization for Economic Cooperation and Development (OECD), and International Energy Agency (IEA).

Our work was performed in accordance with generally accepted Government auditing standards, except that we did not seek agency comments because this report is not an evaluation of a Federal agency's performance. However, officials from the Departments of Energy and State, the Army Corps of Engineers, and the Appalachian Regional Commission reviewed a draft of this report. They generally agreed with the content and their suggestions to enhance the technical accuracy have been incorporated in the report where appropriate.

CHAPTER 2

EUROPEAN AND PACIFIC RIM STEAM COAL DEMAND: CURRENT AND PROJECTED

The reduction of overall energy consumption, uncertainty over future oil and coal prices, economic difficulties caused by the recession, and concern over the cost of complying with environmental regulations, have caused energy buyers to delay oil-to-coal conversion decisions and have slowed steam coal demand growth in recent months. Growth in coal consumption to 1990 is likely to be slower than projected. Projections beyond 1990 are impossible to quantify with any degree of confidence.

Future European and Pacific Rim demand for steam coal will be influenced by economic growth, price of oil, stability of the world oil market, energy conservation practices, developments in competing fuels and energy sources (such as nuclear and solar), technological advances in coal combustion, and future environmental protection measures.

PREVIOUS PROJECTIONS

Since 1978, extensive studies and reports have addressed current and future steam coal markets and have projected demand and supply figures. Demand projections vary considerably, but the trend is generally for greater growth.

We reviewed the following major steam coal studies:

Steam Coal: Prospects to 2000, published by the International Energy Agency in 1978.

Future Coal Prospects: Country and Regional Assessments, a report of the World Coal Study (WOCOL) by the Massachusetts Institute of Technology in 1980.

Draft Interim Report of the Interagency Coal Export Task Force (ICE) issued by the Department of Energy in January 1981.

Potential Role of Appalachian Producers in the Steam Coal Export Market: Task #1, International Steam Coal Trade Analysis, prepared for the Appalachian Regional Commission by ICF, Inc., in November 1981.

Western Coal Exports prepared by the Western Coal Export Task Force of the Pacific Basin Steam Coal Export Study for the Western Governors' Policy Office (WESTPO) in December 1981.

Coal Prospects and Policies in IEA Countries, 1981 Review, issued by the IEA in 1982.

U.S. Coal Exports: Projections and Documentation, issued by the Energy Information Administration (EIA) in March 1982.

Looking Ahead to 1995: A Forecast for U.S. Coal by the National Coal Association (NCA), issued April 1982.

Table 2 shows the range of the estimates.

Table 2

Comparative Steam Coal Import Projections
(1985 to 2000)

	IEA 1978	WOCOL 1980	ICE 1981	ICF 11/81	WESTPO 12/81	IEA 1982	EIA 3/82	NCA 4/82
	(millions of short tons)							
Europe-EEC[a]								
1985	120	-	77-99	79	-	-	89	-
1990	106	73-137	113-154	142	-	-	139	-
1995	-	-	-	215	-	-	179	-
2000	249	101-265	189-254	-	-	-	216	-
Europe-Total								
1985	130	-	97-123	103	-	-	114	108
1990	119	92-160	146-190	178	-	135	172	165
1995	-	-	-	262	-	-	235	-
2000	277	142-422	268-343	-	-	-	294	-
Pacific Rim								
1985	-	32	43	58	72-78	-	52	50
1990	-	79	90	117	130-148	-	109	105
1995	-	-	-	200	-	-	169	-
2000	-	229-263	202-222	-	-	-	235	-
World Total								
1985	-	119-170	140-166	161	-	-	191	178
1990	-	-	236-280	295	-	-	315	300
1995	-	-	-	462	-	-	440	-
2000	-	340-771	470-565	-	-	-	572	-

[a]European Economic Commission.

Although industry representatives believe the overall long-term trend indicated by these studies is still considered valid, specific projected volumes are generally considered unrealistically high in view of reduced growth in demand for electricity in recent years.

Estimates were based upon assumed economic growth rates that have not materialized. For example, in 1980 the European Economic Commission projected the European Community's demand for coal assuming a sustained economic growth of 3 to 3.5 percent a year. However, the general economic growth within the European Community since 1980 has been much lower, and the European Community is now assuming an average economic growth rate of 2.5 percent a year to the year 2000. A prominent EEC official, however, stated that these figures may still be too high.

The Pacific Rim countries also are now experiencing declining economic growth and energy demand growth. Over the past 20 years, the economic growth and energy consumption trends of Japan, Korea, and Taiwan grew at two to three times the rate of the United States. The annual growth rates of electricity consumption over the past 20 years have been about 19 percent for Korea, 12 percent for Taiwan, and 8 percent for Japan. Nevertheless, these countries have not been immune to the current worldwide economic slowdown. For example, Japan's economic growth rate of about 10 percent during 1963-73 dropped to 4 percent by 1980 and the government's latest energy plan predicts future economic growth will be between 5 and 5.5 percent; others, however, estimate that it may be as low as 3 percent.

STEAM COAL DEMAND BY ECONOMIC SECTOR

At the present time, the electric utilities are the major users of steam coal, but general industry holds the greatest growth potential, as discussed on page 9.

Table 3

Steam Coal Consumption By Sector-1981
(millions of metric tons)

Sector	Quantity	Percent of Total
European Community:		
Electric utilities	180.7	82
General industry	24.3	11
Residential	16.5	7
Total	221.5	100
Pacific Rim:		
Electric utilities	15.7	43
General industry	16.8	47
Residential	3.5	10
Total	36.0	100

Electricity generation

Future coal use in electricity generation depends primarily on the growth of electricity demand, which has now become uncertain. For example, in 1980 the European Economic Commission assumed an average growth in electricity demand of 3.5 percent in forecasting electricity demand for 1990 and 2000. However, electricity generation actually fell by 0.6 percent between 1980 and 1981.

Future electricity demand may grow, but how soon and how much largely depend on the rate of economic recovery and the effect of energy conservation practices throughout the world. Coal and nuclear power still have cost advantages over oil and are the preferred choices for providing baseload electrical power. France's strategy, for example, is to provide its baseload requirements from the most economical source--nuclear plants--and to provide peaking power largely from coal-fired plants. Based on nuclear projects already under construction, Belgium anticipates that the use of nuclear energy in electricity generation will increase from 16 percent in 1980 to almost 40 percent by 1990. Many other countries, however, have deferred nuclear programs for various reasons and are planning to use coal for expanding generating capacity.

The International Energy Agency projected that coal use for electricity generation would increase substantially from 1980 to 1990 in Europe and the Pacific countries, although it cautioned that over half of the planned additions to capacity were not yet under construction so delays would undoubtedly occur. The IEA reported that conversion of existing oil-fired power plants to coal has been pursued with varying degrees of vigor by its member countries. Germany, for example, has not seen conversion to be economical because many of its single-fuel, oil-fired plants are fairly new, although it has switched its bi- or tri-fuel plants to coal and generally restricts operation of the oil-fired plants to peak load periods. Italy and Japan are actively pursuing conversion, and Denmark has converted most of its plants to coal. In other countries, however, conversion has not yet started or is still in the planning stage.

General industry

The general industry sector has the potential to be the fastest growing steam coal market to 1990 and beyond. A May 1982 study by IEA's Coal Industry Advisory Board reported that a steam coal market in OECD countries[1] of up to 500 million tons

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[1]Member countries of OECD are Australia, Austria, Beglium, Canada, Denmark, Finland, France, the Federal Republic of Germany, Greece, Iceland, Ireland, Italy, Japan, Luxembourg, the Netherlands, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland, Turkey, the United Kingdom, and the United States.

per year by 1990 and 700 million tons per year by 2000 is technically and economically feasible. It cautioned that many constraints must be overcome to realize that potential, including industrialists' perceptions of conversion inconvenience and the lack of cash resources for investment, since the decision to convert an existing boiler or furnace is a balance between fuel and other operating costs and capital required. The study concluded that some government measures to stimulate conversions would be desirable, particularly in the financial and environmental areas, to encourage a more rapid response by industrialists to underlying market forces.

Residential

The residential/commercial building sector, composed of many small consumers, does not hold much potential for further coal use, with two exceptions. Coal-fired district heating systems represent one method of efficient coal use in this sector. Denmark, which projects that over 33 percent of its 1985 heating demand will be met through district-heating systems, and Sweden, which projects 50 percent by 1990, are among the few countries with significant potential in this area. Germany and France also have projects underway, and Ireland and the United Kingdom are looking at combined heat and power plants. Not much is happening in other countries. The second method for coal use in this sector, and one which may ultimately have more potential, is the use of electricity (from coal-fired power plants) as an end-use energy source, by replacing oil and gas furnaces with electric heat pumps.

FACTORS INFLUENCING COAL DEMAND

Many factors will influence future European and Pacific Rim demand for steam coal. General economic recovery and energy demand growth have already been discussed. The remainder of this chapter deals with other factors which may also have some important bearings on future steam coal demand.

Stability of the world oil market and the price of oil

Rising oil prices and unstable oil suppliers provided the incentive in the 1970s for the energy consuming world to begin switching to coal. However, the current softness of world oil prices has caused many major consumers to hesitate in converting to coal. Signs of weakness in Organization of Petroleum Exporting Countries' influence over production levels and prices has generated buyer uncertainty about the long-run relationships between oil and coal prices. The falling oil prices, coupled with the recent tight money and credit conditions, have caused consumers to postpone decisions on fuel-switching.

Although coal has generally enjoyed a cost advantage over oil, the margin is decreasing as oil prices weaken. It is no longer possible to confidently predict the price gap between oil and coal; thus economic tradeoffs and payback periods are more difficult to assess.

At the present time, there is no excess demand in the world oil market which could result in substantial oil price increases and improve coal's position again. Continued low oil prices will undoubtedly slow oil-to-coal conversions and depress coal demand growth.

Future of nuclear power programs

Since nuclear power and coal are competing energy sources used for the generation of electricity, the future of foreign nuclear programs will directly affect projections for foreign coal consumption.

According to the IEA, nuclear electricity-generating plants are more economical than oil or coal-fired plants in Europe and Japan. Public opposition to nuclear energy, however, could stall plans for new nuclear plants and force development of coal-fired plants for baseload needs.

It is difficult to predict the degree to which current plans for nuclear power will be implemented due to uncertain future energy demand, longer construction lead times for nuclear plants than for coal-fired plants, and increasing public sentiment against nuclear energy. In Japan and certain European countries, there are growing concerns about the viability of nuclear power plants because of waste disposal problems, events such as the Three Mile Island nuclear accident, new-plant siting difficulties, and a leak of irradiated water in 1981 at a Japanese nuclear plant. Thus, projections of installed nuclear capacity in OECD countries in 1990 have been reduced to less than one-third of the 1973 projection.

By 1990, France and Belgium will be generating much of their electricity from nuclear plants. The nuclear programs of other European countries and the Pacific Rim countries are not this far along. Some other countries are encountering severe opposition to further nuclear development.

Abandonment or delay of nuclear energy would improve the demand outlook for steam coal, but uncertainty over the future of nuclear power development programs in many countries translates into uncertainty over future coal demand.

Development of coal technology

Beyond the year 2000, several new technologies, including some just entering commercial use, are likely to increase the

demand for coal by reducing burning and transporting costs as well as eliminating some current objections to its use.

Many current objections to using coal center around the view that it is dirty, difficult and inconvenient to handle and store, and environmentally unacceptable. New technologies are aimed at overcoming these problems as well as improving the economics of coal versus oil and gas.

Coal cleaning

Coal is cleaned to remove dirt and ash, and sometimes sulfur, to improve heating value and reduce ash content and emissions. With the increased concern over sulfur dioxide emissions in recent years, cleaning practices have focused on maximizing sulfur removal, particularly in the United States and Germany. Although washing coal will remove dirt and some pyritic sulfur, chemical cleaning can remove virtually all pyritic sulfur and up to 50 percent of organic sulfur. However, chemical cleaning may not remove ash and mining waste and may need to be combined with washing. Organic cleaning techniques using micro-organisms are also under study.

Coal-liquid mixtures

Composite fuel mixtures, such as coal and oil or coal and water, are already entering commercial use. They may have a more immediate impact upon increasing coal demand than some of the other technologies under development, since they allow many oil burning facilities to burn coal with the same basic equipment. Both mixtures are now being commercially produced in the United States. Several U.S. utilities are burning coal-oil mixtures and others are testing coal-water mixtures. If an export market were to develop, these fuels could also be transported through pipelines and tankers. This technology could offer an economic advantage to both electric utilities and general industry.

Fluidized bed combustion

Fluidized bed combustion (burning pulverized coal at low temperatures in a bed or beds of sand and/or limestone through which fine jets of air are passed) offers an improved method of coal combustion in both the industrial steam heating and the power generation markets. The advantages are the ability of a fluidized bed combustor to burn any type or quality of coal while significantly reducing sulfur emissions without costly flue gas treatment. Also, the lower combustion temperature reduces nitrogen oxide emissions and ash formation.

Superior heat transfer characteristics in a fluidized bed plant offer the potential to reduce the plant size, compared with traditional coal-fired plants, and this improvement can

ease the substitution of coal for oil in some industrial/power station situations. Fluidized bed combustors are now becoming commercially available, which greatly increases the potential for coal use in general industry.

Other technologies which could increase coal use in the more distant future include (1) coal liquefaction and gasification for use in place of natural gas and petroleum products, (2) fly ash processing to recover and use waste byproducts of coal combustion, and (3) fuel cells using coal-derived fuels.

Work also continues on developing improved methods of transporting coal. Slurry pipelines are being used commercially and a number of companies are proposing to build additional lines pending the outcome of right-of-way legislation in the Congress.

Competing energy sources

The next 15 years will undoubtedly see considerable technological development in other energy sources as well as in coal. Some alternative energy sources, such as solar energy, offer the advantage of indigenous production as well as little or no requirement for pollution controls. If some of these technologies are developed to the point where they become economically attractive, they could offer strong competition for coal.

Because of the time required for significant market penetration, however, even if new technologies become commercially available, little effect is likely to be felt in aggregate consumption figures for 15 to 20 years. On the other hand, the end of this century is likely to see considerable hesitancy on the part of consumers to replace aging equipment with conventional fossil fuel-fired equipment if new equipment using renewable energy sources has been demonstrated to be reliable and commercially available at attractive prices and offers the prospect of low operating costs with no pollution.

Environmental protection measures

Concerns about the environmental consequences of using coal, costs of complying with environmental standards, and uncertainty as to whether the standards will be changed all contribute to some doubt about switching to coal. Our discussions with government coal officials in most of the countries we visited revealed that no significant additional environmental standards are being proposed at this time although there is a general recognition that additional controls may be necessary in future years. It is generally agreed that unless there is a balance between environmental protection measures and their cost, such cost can create a significant disincentive to increased coal use.

The environmental impact of producing and transporting coal is for the most part economically controllable. Coal's primary environmental impact results from the combustion process, which emits oxides of sulfur and nitrogen and suspended particulate matter. This type of pollution is first felt near areas of high combustion levels, but it also affects other regions through long-distance transport of the pollutants which, under certain atmospheric conditions, may contribute to the formation of acid rain. This latter issue is receiving increasing attention in Germany and Northern Europe, where it has become a particular problem, and it may affect future European steam coal use.

At present, no international regulations exist for air quality or emission standards, although OECD and the EEC are studying the question. Individual countries develop and enforce their own environmental protection measures, which tend to vary somewhat by nature and range of standards. The most common standards concern the level of sulfur oxides and suspended particulates. Current methods of complying with these standards are to disperse the pollutants into the atmosphere; limit the amount of sulfur, dust, or ash released in the combustion process by using coal of low sulfur and/or ash content; remove sulfur from coal before burning it; or install flue gas scrubbers.

Environmental control measures increase the cost of coal use, thus eroding its comparative cost advantage over oil. Many countries apply stricter standards to new combustion equipment than to existing equipment. Since most existing equipment is oil or gas-fired, coal-fired equipment would be among the new types of equipment being considered and would be subject to the stricter standards.

Research, development, and demonstration

Research, development, and especially demonstration of new technologies are vital to enhance the prospects for coal use. The EEC stresses the importance of demonstrating the technical and commercial viability of new processes and in September 1982 proposed financial incentives to support investment in (1) large coal-fired boilers to produce heat for industrial parks, communities, or district heating systems, (2) converting industrial oil-fired installations to coal using new technologies, (3) preparing coal for users other than power stations and coke ovens, and (4) generating energy from urban, agricultural, and industrial waste.

Soviet natural gas pipeline

The general consensus among Europeans and the State Department is that the Soviet natural gas pipeline to Europe is not expected to have a major near-term impact upon the steam coal market. Europe uses gas largely in its residential and light

industry sectors. Coal will probably never penetrate the residential market in direct form but may be used indirectly if residential use of electricity for heating increases. Unless the Soviets significantly reduce the price of their gas, coal will probably retain a significant price advantage for heavy industrial applications. In the longer term, however, imported coal and Soviet gas may compete for the light- to medium-industrial market as new technologies increase coal's convenience and performance.

CHAPTER 3

THE U.S. POSITION IN THE EUROPEAN AND PACIFIC RIM STEAM COAL IMPORT MARKETS

Competition in the world steam coal market is keen. South Africa, Australia, and Western Canada are increasing production and export capacity. Colombia is expected to enter the European market by the late 1980s. China is preparing to play a stronger role in the Pacific market but will not be a major factor until nearly 2000. Poland, no longer the primary supplier to Europe, is having production difficulties in the face of rising domestic demand but is still a strong competitor.

Before 1990, the major determinant of market share will be delivered price. Since the United States is the high-cost supplier and price leader in both the European and Pacific Rim markets, its market share may be determined by the price levels chosen by South Africa and Australia, the two lowest-cost exporters, and their export capacities relative to total demand. Buyer preferences for diversified supply sources, supplier reliability, and quality of coal will be important, but price will be the major determinant. If South Africa and Australia continue to opt for high profit levels by setting their prices only marginally under U.S. prices, the United States will retain a substantial share of the export market through 1990. On the other hand, if overall demand declines sufficiently, South Africa and Australia may decide to cut their prices to maintain export levels at the expense of U.S. market share.

It is impossible to quantify with any degree of confidence the long-term demand for steam coal. Nevertheless, demand is expected to increase significantly. If world demand surpasses the combined export capacity of lower cost exporters, the U.S. market share should increase rapidly in both Europe and the Pacific Rim. Even with these increases, however, total U.S. exports of both steam and metallurgical coal are expected to remain in roughly the same proportion to total production (under 15 percent) as they are now.

PRICE AND COST COMPARISONS

As table 4 indicates, the price of U.S. steam coal must be reduced or offset by other considerations if U.S. suppliers are to increase their market share in the future.

Table 4

Comparative Imported Steam Coal Prices in mid-1981

To Europe from:	Price FOB port	Ocean freight	Delivered price
U.S. east coast	$50	$18	$68
Poland	54	8	62
South Africa	43	13	56
Australia	44	26	70
To Japan from:			
U.S. east coast	50	28	78
South Africa	43	22	65
Australia	44	16	60

Source: Coal Week International, Mar. 18 and 25, 1981. U.S. ocean freight does not include demurrage charges incurred in 1981 at Baltimore and Hampton Roads.

Future market shares should not be projected on the basis of recent market performance. Prices and demand were unusually high in 1981; supply was short and buyers were willing to pay higher prices. In mid to late 1982, demand had slackened and supply had increased. This, coupled with the economic recession, created a depressed coal market and also depressed ocean freight rates. U.S. coal companies were selling at cost in some cases.

ICF Inc., in a November 1981 study for the Appalachian Regional Commission, compared the production factors of the major competing coal exporters and projected the estimated delivered cost of steam coal in 1990 from which it estimated probable 1990 market shares. Table 5 represents estimated costs to deliver to the respective markets, not estimated prices. ICF's mine cost figures include a "fair" return on investment in attempting to arrive at a representative marginal cost for each supplier country. Market prices and resulting market shares will depend upon the level of demand, government policy, and the market strategies of South Africa and Australia.

Australia is the low-cost supplier to the Pacific market, but South Africa, due to shorter shipping distance, has considerable advantage over Australia in Europe. ICF did not analyze Poland's costs, stating that Poland's export levels would be determined by government policy within production limits.

Table 5

Estimated Cost Competitiveness in 1990
Bituminous Steam Coals, One Percent Sulfur or Less
in 1981 Dollars per short ton (note a)

	Mine cost	Rail freight	Ocean freight	Delivered cost
To Europe from				
U.S. east coast	$42	$11	$11	$64
South Africa	22	9	15	46
Australia				
New South Wales	23	4	23	50
Queensland	24	6	23	53
Western Canada	29	12	22	63
To Japan from				
U.S. west coast (Utah)	25	19	13	57
South Africa	22	9	16	47
Australia				
New South Wales	23	4	10	37
Queensland	24	6	9	39
Western Canada	29	12	10	51

[a]Costs have been adjusted for Btu differences from the various supply regions to reflect costs for a short ton, i.e., 24 million Btu per ton.

European and Pacific Rim buyers say that the high delivered cost of U.S. coal is their primary obstacle in considering more long-term, high-volume contracts for U.S. coal. They routinely cite the high charges for U.S. inland and ocean transportation as their major concern.

Compared with other coal-supplying countries, the United States is in a favorable position due to its immense coal reserves, large and flexible production base, broad range of good quality coal, and relatively good record as an exporter. European coal buyers generally view the United States as a natural source of supply due to its relative proximity. They also like the flexibility of the U.S. coal market, with its demonstrated ability to respond quickly to rapidly changing market conditions. Europeans view the U.S. free pricing system, with competition between producers of all sizes, as a definite advantage

in holding world prices down. Finally, the United States is viewed as a relatively stable source of supply, free of Government interference in exports and pricing.

Whether or not ICF's projections turn out to be on target, they do clearly illustrate the three major cost factors that make up delivered cost and that determine each supplier's market position. Mining cost is the only cost factor that is even marginally under control of the coal producer. Even here, the major cost determinant is the geological conditions in which the coal is located.

Most U.S. export coal comes from underground Appalachian mines where production costs are high compared with those of Australia and South Africa. Western U.S. coal production costs are competitive but suffer from long and expensive rail hauls to the port. Both South African and Australian coal is produced relatively close to ports.

SECURITY OF SUPPLY

Security of supply is a major concern of importing nations and is generally addressed by (1) maintaining indigenous production, and (2) diversifying import sources. Coal production in most European and Pacific Rim importing countries is at its physical upper limit and is declining.[1] As consumption increases, therefore, so will the import of coal.

The bulk of European coal is from deep mines and is more costly to produce than to buy from overseas suppliers. For example, the average cost was $99 to $125 a ton at the end of 1981 while the average price of imports, including ocean freight, was $70 a ton or less. The EEC estimates that only 20 to 25 percent of indigenous coal is profitable (mostly that from open pit mines) and fully competitive with imported coal.

Domestic coal in Japan and Taiwan is also more expensive than imported coal because, as in Europe, most of the domestic coal comes from deep shaft mines. The IEA has concluded that major constraints against increasing Japanese production from its current level of about 18 million metric tons (mmt) a year include high mining costs, lack of available labor, difficulty in securing production safety, and limits in introducing modern mining systems. Taiwan also suffers from much the same problems, including labor-intensive mining methods and insufficient labor forces.

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[1]EEC coal-producing countries include Belgium, France, Germany, and the United Kingdom. All three Pacific Rim countries included in this review produce some coal.

Most European and Pacific Rim coal-producing countries maintain coal production through federal subsidies or other support. For example, Germany subsidized its domestic coal production at a level of about DM 6 billion in 1981 (about $2.4 billion at the exchange rate of $1 equal DM 2.50). According to the EEC, in the past 7 years the cost of European federal subsidies has tripled in nominal terms and doubled in real terms. Coal-producing countries are finding it increasingly difficult to finance this support in view of growing pressure on government budgets, but they expect to maintain current production levels through these subsidies to meet the twin objectives of security of supply and maintaining employment.

About 23 percent of coal consumed within the EEC in 1981 was imported from countries outside the Community. The EEC predicted that imports in the year 2000 could be three to four times the 1981 volume.

The Pacific Rim countries currently rely heavily on coal imports, and the volume of such imports may increase significantly over the long term. Japan imported 80 percent of its total coal requirements in 1980, and Taiwan imported over half of its steam coal supply. Korea depends almost totally on imports.

Import policies

Individual governments generally encourage diversification of energy supplies by type of energy as well as geographic origin. Some governments have specific coal import policies. For example, German users of steam coal may import from outside the EEC only through a complex quota system that requires purchasing a certain amount of domestic steam coal for each ton of imported coal and then imports can be made only after demand exceeds a base consumption quota of domestic coal.

Coal import policies of Japan and Taiwan are also guided by a desire to protect domestic coal production. For example, the Japanese Ministry of International Trade and Industry, which monitors domestic coal production and is responsible for coal imports, issued administrative guidance in July 1982 that at least 20 percent of all coal used in Japan should be procured from domestic sources. (The Ministry's 1982 domestic coal production target was 18 mmt.) The Taiwan energy policy includes a goal of maintaining indigenous coal production of 3 mmt per year and the Taiwan Provincial Bureau of Mines regulates the amount of coal imports throughout the year to avoid shortages and overproduction.

Importing countries' policy decisions on import supplier diversification as well as their perceptions of the reliability of each supplier may offset pure price competition in many cases. As noted in the following section, U.S. coal is high

priced but offers the advantage of supply reliability compared to other import sources. Some foreign steam coal buyers told us that they will pay a premium for supply reliability but generally draw the line at about $10 per ton.

MARKET SHARE COMPETITION

The European and Pacific Rim steam coal import markets are considerably different, especially with respect to the dominant suppliers.

European market

Poland was the major supplier of steam coal to the Western European market until recent years, when it was displaced by South Africa and the United States, as shown in table 6.

Poland was once the world's second largest coal exporter, reaching a production peak of just over 200 mmt and 41.4 mmt of exports (both met and steam) in 1979. Western and Eastern Europe were natural markets for Polish coal due to their proximity. But labor unrest and political turmoil caused coal production and exports to plummet. Exports fell to 15 mmt in 1981 (7 mmt to Western Europe and 8 mmt to Eastern Europe), a 64-percent decline from 1979. Particularly hard hit were Denmark, France, Italy, and Germany, whose long-term contracts were abruptly reduced or interrupted. In 1982, however, additional Polish coal was offered in Europe as Poland struggled to regain some of its former market share which had been taken over largely by the United States and South Africa. Because of an acute need for hard currency, Poland was offering its coal at low prices. The strategy worked, as 1982 Western Europe import statistics show modest increases in coal from Poland. Despite these increases, Poland is not likely to completely recapture its former market share. Even before its production difficulties in 1980, Polish officials had projected that total coal exports would decline to about 30 mmt per year (about 20 to 22 mmt would be steam coal) because of increasing domestic consumption. Furthermore, some European buyers now fear further supply interruptions and will be reluctant to enter into long-term contracts with Poland.

Table 6

Western European Steam Coal Imports from Non-EEC Countries
(1973 to 1980)

1973		
Exporter	Mst	%
Poland	10.8	55
United States	3.3	17
Russia	3.2	16
Other	0.9	6
South Africa	0.8	4
Australia	0.4	2
Total	19.6	

1974		
Exporter	Mst	%
Poland	14.5	55
Russia	3.8	14
United States	3.3	12
Australia	1.9	7
South Africa	1.3	5
Other	1.3	5
Canada	0.4	2
Total	26.5	

1975		
Exporter	Mst	%
Poland	14.3	46
United States	6.4	21
Russia	3.5	11
Austrialia	3.4	11
South Africa	1.8	7
Canada	0.9	3
Other	0.8	3
Total	31.1	

1976		
Exporter	Mst	%
Poland	15.6	51
United States	4.2	14
South Africa	4.0	13
Russia	3.9	13
Australia	1.8	6
Canada	0.7	2
Other	0.3	1
Total	30.5	

1977 (EEC only)		
Exporter	Mst	%
Poland	11.5	39
South Africa	8.4	29
Russia	3.2	11
United States	2.8	10
Australia	2.8	10
Other	0.4	1
	29.1	

1978		
Exporter	Mst	%

(Data not readily available)

1979		
Exporter	Mst	%
South Africa	22.3	40
Poland	20.3	36
United States	7.3	13
Australia	4.0	7
Russia	1.7	3
Canada	0.6	1
Total	56.2	

1980		
Exporter	Mst	%
South Africa	23.0	37
Poland	18.0	29
United States	14.1	22
Australia	4.5	7
Canada	1.7	3
Russia	1.5	2
	62.8	

[a]Mst means millions of short tons.

Source: 1973 - 1977 Steam Coal: Prospects to 2000, IEA, 1978.
1979 - 1980 Potential Role of Appalachian Producers in the Steam Coal Export Market, Task #1, International Steam Coal Trade Analysis, prepared for the Appalachian Regional Commission by IFC, Inc., November 1981.

South Africa is becoming an increasingly strong competitor in the European market, with high-quality coal generally priced lower than U.S. coal. It has large reserves of steam coal and a good record of capacity expansion. The government has developed excellent rail and port facilities, with stated goals of increasing annual export capacity to 48.5 mst by 1986 and 88 mst by the mid 1990s.

Australia also exports steam coal to Europe, but the long distance keeps its delivered price comparatively high. In recent years, strikes at Australian coal mines and ports have reduced exports and created some uncertainty about the reliability of future supplies.

The United States is also viewed with some uncertainty as a reliable and stable supplier for the European market because of several events in 1980 and 1981. Following the decrease in Polish exports and the Australian strikes, sudden additional demand was concentrated on U.S. suppliers by both European and Japanese buyers. U.S. suppliers were able to meet the demand, but the result overloaded east coast ports, which forced European importers to pay high demurrage charges on ships, significantly increasing the delivered cost of their coal. Other suppliers worldwide took advantage of the U.S. situation to raise their own coal prices by an amount equivalent to demurrage in the United States. The EEC estimates that this rise in world coal prices cost the Community about $500 million in 1981. Although the U.S. port situation is stable now, this incident contributed to the European view that no country, including the United States, can be considered a completely reliable supplier.

Pacific Rim market

Australia's closeness to the Pacific Rim countries and low delivered price makes it the natural supplier to that market. However, its strikes have caused some Pacific Rim buyers to become concerned about Australian domination of their steam coal market. Pacific Rim electric power companies and government officials have indicated a desire to reduce their dependency on Australia in order to achieve a greater security of supply through diversification.

Australia has projected its steam coal exports at 33 to 44 mst by 1985 and 55 to 77 mst by 1990. It historically exported more than 80 percent of its steam coal to Europe until 1978, when Pacific Rim purchases began increasing; in 1980 about 44 percent went to Western Europe and 54 percent to the Pacific Rim. Australia projects that about 25 percent of its 1985 steam coal exports will go to Europe, 68 percent to Japan and other Asian countries and 7 percent elsewhere. It's 1990 projection is 26 percent to Western Europe, 66 percent to Japan and other Asian countries, and 8 percent elsewhere.

Pacific Rim steam coal buyers would like to purchase U.S. coal because of its quality and to diversify their sources, but the cost of delivered coal inhibits U.S. exporters from strong competition with Australia.

Canada, like the United States, also has the problem of long rail hauls over mountainous terrain to the port and a long

ocean haul to market. China is preparing to export steam coal in larger volumes, but will probably not be a major factor until nearly 2000 since it must (1) develop all necessary production, rail, and port facilities nearly from scratch, and (2) meet a large and growing domestic market.

U.S.-Japanese energy trade relationships are being studied by a joint U.S.-Japan Energy Working Group which was established through U.S. initiatives on January 19, 1983, to identify and resolve impediments to private investment and free trade in energy. Table 7 shows the extent of Japan's imports by source during 1976-81. The increased steam coal imports in recent years are attributed primarily to continuing fuel-switching programs by Japanese utilities and cement producers.

Table 7

Japanese Steam Coal Imports
(1974 to 1981[a])

1976			1977			1978		
Exporter	Kmt	%	Exporter	Kmt	%	Exporter	Kmt	%
Australia	248	41	Australia	527	56	Australia	749	69
USSR	211	35	USSR	237	25	China	173	16
China	125	21	China	167	18	USSR	123	11
South Africa	15	2	South Africa	6	1	South Africa	25	2
Indonesia and Poland (I&P)	4	1	Canada	-	-	Canada	12	1
United States	-	-	I&P	-	-	I&P	-	-
Canada	-	-	United States	-	-	United States	-	-
Total	603		Total	937		Total	1,082	

1979			1980			1981		
Exporter	Kmt	%	Exporter	Kmt	%	Exporter	Kmt	%
Australia	1,282	76	Australia	4,517	62	Australia	5,398	44
China	236	14	China	741	10	United States	2,331	19
USSR	129	8	United States	640	9	South Africa	1,853	15
South Africa	29	2	Canada	600	8	China	1,305	11
I&P	1	-	South Africa	487	7	Canada	1,109	9
Canada	-	-	USSR	248	3	USSR	271	2
United States	-	-	I&P	1		I&P	5	
	1,677		Total	7,234		Total	12,272	

[a]Japanese fiscal year runs from Apr. 1 to Mar. 31.

[b]Kmt means thousand metric tons.

Source: Institute of Energy Economics, Tokyo.

PROJECTED MARKET SHARES

Most analysts feel that South Africa and Australia prefer to let the United States be the price setter, which allows them to optimize profits by following the U.S. lead. If the demand for steam coal declines and the market softens, however, South Africa and Australia may change their strategy to that of strong price competition in order to keep export and revenue levels high.

The three major studies discussed on pages 6 and 7 concluded that U.S. exports were expected to increase substantially in the next two decades, but the studies varied on the percentage share of the markets the United States might capture, as shown in tables 8, 9, and 10.

Table 8

Projected Western European Steam Coal Import Market Shares of Non-EEC Suppliers (1985-2000)

1985

ICE - 1/81 (note a)			ICF - 11/81			NCA - 4/82		
Exporter	Mst	%	Exporter	Mst	%	Exporter	Mst	%
Poland	44	40	South Africa	39	38	South Africa	41	38
South Africa	22	20	United States	28	27	United States	31	29
United States	18	16	Australia	16	16	Poland	11	10
Australia	18	16	Poland	14	14	Australia	8	7
Colombia	8	7	Canada	5	5	USSR/China	7	6
						Colombia	4	4
						Canada	3	3
						Others	3	3
Total	110		Total	102		Total	108	

1990

ICE (note a)			ICF			NCA		
Exporter	Mst	%	Exporter	Mst	%	Exporter	Mst	%
Poland	55	33	South Africa	61	35	South Africa	64	39
South Africa	33	19	United States	48	27	United States	43	26
United States	32	19	Australia	28	16	Poland	25	15
Australia	32	19	Poland	18	10	Colombia	12	7
Colombia	17	10	Colombia	16	9	USSR/China	10	6
			Canada	5	3	Canada	6	4
						Others	3	2
						Australia	2	1
Total	169			176			165	

1995-2000

ICE - 2000 (note a)			ICF - 1995		
Exporter	Mst	%	Exporter	Mst	%
United States	89	29	South Africa	80	31
Australia	89	29	United States	64	25
Poland	55	18	Australia	63	25
South Africa	45	75	Colombia	23	9
Colombia	30	10	Poland	18	7
			Canada	9	4
Total	308		Total	257	

[a]Midpoint of range projected by ICE, and assuming South African exports split evenly between Europe and the Pacific Rim.

Table 9

Projected Pacific Rim Imported Steam Coal Market Shares (1985 - 2000)

1985

ICE (note a)			ICF			NCA		
Exporter	Mst	%	Exporter	Mst	%	Exporter	Mst	%
South Africa	22	51	Australia	28	48	Australia	24	48
Australia	18	42	USSR/China	11	19	United States	11	22
United States	2	5	United States	8	14	Canada	8	16
China	1	2	Canada	7	12	USSR/China	3	6
			South Africa	4	7	South Africa	2	4
						Others	2	4
Total	43		Total	58		Total	50	

1990

ICE (note a)			ICF			NCA		
Exporter	Mst	%	Exporter	Mst	%	Exporter	Mst	%
Australia	38	42	Australia	46	39	Australia	53	50
South Africa	33	37	United States	23	20	United States	23	22
China	10	11	Canada	18	15	Canada	14	13
United States	7	8	USSR/China	18	15	USSR/China	7	7
USSR	2	2	South Africa	12	10	South Africa	4	4
						Colombia	2	2
						Others	2	2
Total	90			117			105	

1995-2000

ICE - 2000 (note a)			ICF - 1995		
Exporter	Mst	%	Exporter	Mst	%
Australia	98	46	Australia	73	37
South Africa	45	21	United States	48	24
United States	32	15	Canada	31	16
China	30	14	USSR/China	26	13
USSR	7	3	South Africa	22	11
Total	212		Total	200	

[a]Midpoint of ranges projected by ICE, and assuming South African exports split evenly between Europe and the Pacific Rim.

Table 10

Comparative Projections
World Imported Steam Coal Market Shares
(1985 to 2000)

1985

ICE (note a)			ICF			NCA		
Exporter	Mst	%	Exporter	Mst	%	Exporter	Mst	%
South Africa	45	29	United States	50	28	United States	55	31
Poland	44	29	Australia	47	26	South Africa	45	25
United States	28	18	South Africa	45	25	Australia	35	20
Australia	18	12	Poland	14	8	Canada	12	7
Colombia	8	5	Canada	12	7	Poland	11	6
Canada	4	3	USSR/China	11	6	USSR/China	10	6
China	4	3				Others	6	3
USSR	2	1				Colombia	4	2
Total	153		Total	179		Total	178	

1990

ICE (note a)			ICF			NCA		
Exporter	Mst	%	Exporter	Mst	%	Exporter	Mst	%
South Africa	65	25	United States	88	28	United States	79	26
United States	64	25	Australia	80	25	South Africa	70	23
Poland	55	21	South Africa	75	24	Australia	60	20
Australia	38	15	Canada	23	7	Poland	27	9
Colombia	17	7	Poland	18	6	Canada	21	7
China	10	4	USSR/China	18	6	USSR/China	20	7
Canada	7	3	Colombia	16	5	Colombia	17	6
USSR	2	1				Others	6	2
Total	258		Total	318		Total	300	

1995-2000

ICE - 2000			ICF - 1995		
Exporter	Mst	%	Exporter	Mst	%
United States	196	38	Australia	143	29
Australia	98	19	United States	129	26
South Africa	90	17	South Africa	110	22
Poland	55	11	Canada	40	8
Colombia	30	6	USSR/China	26	5
China	30	6	Colombia	23	5
Canada	14	3	Poland	18	4
USSR	7	1			
Total	520		Total	489	

[a]Using midpoint of ranges projected by ICE and assuming South African exports split evenly between Europe and the Pacific Rim.

CHAPTER 4

U.S. INLAND TRANSPORTATION ISSUES

Most U.S. export steam coal is moved to the ports by rail, and rail rate escalation is a major concern of U.S. coal exporters and foreign buyers, especially in light of the recent Interstate Commerce Commission (ICC) decision to deregulate rail freight rates for export coal. The physical capacity of the rail and barge systems is not considered a problem. At present there is excess capacity, and there is ample time for orderly expansion to meet projected future increases in exports.

The Staggers Rail Act of 1980 (49 U.S.C. 10101) allows the ICC to deregulate rail rates when regulation is not needed to prevent abuses of market power. In 1981, the Chessie System and the Norfolk and Western Railroad filed a petition to deregulate export coal rates. The ICC recently decided in favor of this petition, and U.S. exporters and foreign buyers fear that this will result in higher export rates. Because U.S. coal is already the most expensive in both the European and Pacific Rim markets, they contend that a significant rail rate increase would increase the cost of U.S. coal in these markets and perhaps reduce the U.S. market share.

PHYSICAL CAPACITY

Virtually all steam coal exported from the U.S. east, west, and Great Lakes coasts moves to port by rail. Railroads also play an important role in delivering coal to the Gulf Coast ports. Barges provide strong competition in those locations with major river routes, largely from Midwest States south to the Gulf of Mexico. Trucks are cost-effective only for very short hauls (up to around 150 miles) and no slurry pipelines are now used for export coal.

Coal, the number one commodity carried by the railroads, accounted for over 36 percent of total rail freight tonnage and over 20 percent of total railroad revenue in 1981. From 1971 to 1980, coal freight revenues increased by 282 percent while coal tonnage carried increased by 41 percent.

Representatives of the coal industry and rail companies generally agree that the U.S. inland transportation system has adequate capacity to handle current and projected volumes of both U.S. consumption and exports. They informed us that:

--East coast railroads are underused and, in general terms, there is no shortage of rail cars.

--There is presently a glut of barge capacity; inland waterways are capable of handling more coal exports, but a number of river locks and dams need to be replaced.

--Major railroad companies moving coal to west coast ports have excess capacity now, but would need some additional capacity to meet projected long-term exports. This should not be a problem, however.

Future rail capacity will depend upon availability of financial capital to maintain and expand equipment and systems. Recent studies indicate that railroads will need sufficiently attractive rates to have enough capital to meet physical requirements for future coal movement. For example, Report on the Transportation of Coal, prepared by Booz-Allen & Hamilton, Inc., in December 1981 for the Appalachian Regional Commission, concluded that major disruptions in coal transportation service to the Appalachian region resulting from capital shortages were not likely. However, the report indicated that significant improvements in capacity and service or large changes in the network were unlikely, because most investments (over $10 billion in plant and equipment - $3 billion is coal-related) over the next 10 years will be dedicated to maintaining existing capacity.

The report also indicates that small shippers may experience declining service in some areas as increasing percentages of cars are committed to contract service in large-unit trains. Since long-term capital availability for coal-related investments will depend on adequate profits from hauling coal, large shippers that guarantee minimum shipment levels may receive first preference for rail equipment and service.

According to Booz-Allen, railroad strategies to avoid capital shortfalls include shifting financing burdens to shippers and levying surcharges. Most carriers have required selected shippers to finance construction of switches and side tracks for new facilities, and carriers are encouraging shippers to buy equipment, including both cars and locomotives. Surcharges on unprofitable lines and special contract rates are also likely to continue.

Interstate slurry pipelines could be used to move export coal to ports, provided a number of obstacles can be overcome. Neither of the two existing slurry pipelines (only one still operates) carry coal for export, but several proposed pipelines have some potential for export and one is intended solely for export coal. Several studies have indicated that slurry pipelines could be as cost effective as rail transport in some areas. However, the lack of eminent domain authority, legal problems with water rights, and finding sufficient financial backing pose substantial barriers to the development of such pipelines.

RECENT DEVELOPMENTS THAT MAY AFFECT COST OF RAIL TRANSPORTATION

Recent developments associated with rail rates that may significantly change the cost of transporting coal include the (1) deregulation of rail rates on coal carried for export, (2) potential increased use of long-term transportation contracts, (3) establishment of variable rate tariffs, and (4) railroad mergers and consolidations.

Deregulation of export coal rail freight rates

Under provisions of the Staggers Rail Act of 1980, the ICC recently ruled in favor of a railroad petition to deregulate freight rates on coal carried for export. Proponents of deregulation argued that regulation of export coal rates was unnecessary because the world coal market is highly competitive and deregulation would allow railroads flexibility to negotiate long-term contracts. Opponents said deregulation would allow the railroads to raise their rates to the point that coal exports would be reduced.

The railroads and the Department of Transportation, which favored deregulation, contended that:

--The world coal market is sufficiently competitive to prevent railroads from increasing export coal freight rates to unreasonably high levels. In addition, the railroads have no interest in restricting coal exports since they have as much to lose as the producers if the price of U.S. coal is noncompetitive.

--The exemption is of limited scope, since export coal is only a small portion of domestic coal production.

--Coal exporters are dominated by a relatively few, large, sophisticated companies which control mines located near more than one railroad.

--Individual coal producers can divert supplies to the domestic market.

Coal shippers, domestic utilities, mine owners, shippers of other commodities, the Water Transport Association, the Departments of Commerce and State, and the U.S. Trade Representative, which opposed deregulation, contended that:

--Railroads wanted the exemption so they could increase their export coal rates.

--Rate increases will cause the volume of coal exported to decrease.

--Most producers of export coal are captive to one railroad and arguments that world coal competition exists have little bearing on such a situation.

--The Staggers Act was intended to allow railroads increased flexibility to meet competition from other transportation modes and not to remove maximum rate regulation where a railroad has monopoly power.

--Considering the amount of coal exported in both dollars and tons and the number of railroads and ports involved, the petition is not limited in scope.

--Whatever the difference between the mine's long-term marginal cost and the world price for coal, the railroads would be able to appropriate most of the profit.

Long-term transportation contracts

Long-term export contracts were seen as one way of increasing the efficiency of coal loading facilities during the ship demurrage period of 1980-81. The first contracts implemented after their authorization in the Staggers Act caused problems for some small producers but have the potential for increasing the overall competitive position of U.S. coal exports.

As common carriers, railroads have traditionally been prevented from entering into contracts for their services; however, section 208 of the Staggers Act allows railroads to enter into a contract with one or more purchasers of rail services to provide specific services under specified rates and conditions. A proposed contract must be approved by the ICC and may be challenged by another shipper or the ICC on the grounds that the contract unduly impairs the ability of the contracting carrier or carriers to meet their common carrier obligations or by a port on the grounds that it would be harmed because the proposed contract would result in unreasonable discrimination against the port. The ICC may also limit the right of a rail carrier to enter into future contracts following a determination that additional contracts would impair the railroad's ability to fulfill its common carrier obligations.

According to the Association of American Railroads, contracts allow railroads to move away from quoting an average rate for an average service. Provisions of a contract could include minimum and maximum volumes, ship availability, mine performance, sampling procedures, loading and unloading facilities, escalation clauses, and escape clauses to deal with disasters.

The Norfolk and Western (now known as the Norfolk-Southern) Railroad was among the first to offer contracts for export coal movements. Faced with a ship queue approaching a record length

of 108 vessels and operating its coal piers at less than peak capacity because complete cargos were not available, this railroad developed coal export contracts in October-November of 1980 to increase the efficiency of its coal export operations. These contracts had minimum volume clauses and limited the number of mines that could supply one ship and the number of days that could be taken to load the train, with damages to be assessed if these terms were not met.

For coal exporters able to meet the terms, contracts offer several advantages. Most important, the transhipper is guaranteed a berth for loading its ship, avoiding the demurrage prevalent in 1980-81. The rates paid for hauling coal are also stabilized since charges are based on an agreed escalation clause rather than on cost recovery or revenue improvement increases.

During our interviews with U.S. coal producers and traders, they complained about contracts cutting off small producers who could not meet the minimum annual volume requirements. A railroad official acknowledged that not all customers could qualify for the terms of the original contracts, but he indicated that a second contract had been developed for these smaller customers.

Variable rate tariff

A marketing technique used by the Illinois Central Gulf Railroad to compete with barge lines[1] has potential for providing the railroads with rate-setting flexibility without eliminating ICC regulation. To keep its rates competitive, the Railroad received permission from the ICC to establish variable rate tariffs for coal hauled from Illinois and Kentucky to New Orleans and now lists 15 different approved rates for the same service. Thus, the railroad is allowed to increase or decrease the actual rate charged within the upper and lower limits with 2 days notice to shippers and no further ICC approval.

Mergers and consolidations

Several mergers of major rail companies have occurred since passage of the Staggers Act. If operating efficiencies (more single line through-routes, simplified train makeup, and less car switching) resulting from these mergers are passed on to the consumer, lower rates could result.

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[1]Because their freight rates for bulk commodities are not regulated, barge lines can raise or lower their rates to meet changing market conditions.

CHAPTER 5

U.S. PORT DEVELOPMENT AND OCEAN TRANSPORTATION

The distances involved in moving U.S. steam coal to export markets makes transportation costs critical to the delivered cost of U.S. coal to foreign buyers. There has been a world trend to larger, more efficient deep-draft ships of over 100,000 dead weight tons (dwt). However, U.S. exporters are not able to take advantage of the cost saving of larger ships because no U.S. port is deep enough to fully load a bulk carrier of over 80,000 dwt.

Many foreign buyers and U.S. coal industry officials as well as some State and Federal Government officials advocate dredging one or more U.S. ports to accommodate super-colliers, but the cost of dredging major U.S. coal ports is high.

If the means to accommodate more efficient super coal colliers (either through dredging or some alternative) are not adopted, U.S. steam coal exports may become less cost competitive with alternative sources of energy and/or foreign coal supplies. However, as long as South Africa and Australia can continue to price their steam coal a few dollars a ton under the U.S. price, dredging ports or developing other ways to accommodate cost-saving ships will probably not appreciably increase the U.S. share of the overseas steam coal market.

In the past there were numerous complaints about inadequate throughput capacity of U.S. port terminals and the lack of deep-water ports to accomodate larger coal ships. However, the throughput capacity of U.S. terminals has already been substantially increased and construction of additional capacity is nearly completed.

THROUGHPUT CAPACITY

During the export boom of 1980-81, throughput capacity of the export terminals at the traditional coal ports became a major issue as foreign buyers incurred millions of dollars in demurrage charges. Three major changes were instrumental in bringing ship queues to an end: (1) coal exporters began shifting business to non-traditional coal ports, (2) the railroads instituted rail shipping contracts and ship registration procedures, and (3) demand for steam coal decreased significantly in the latter half of 1982.

Another spurt in demand for U.S. steam coal is unlikely to again overwhelm U.S. port facilities. In the short time since the boom eased, the United States has significantly expanded its total coal export capacity and added to its traditional export transportation patterns.

Coal trade routes expanded

Over half of all U.S. overseas coal exports passed through the traditional coal ports of Hampton Roads and Baltimore in 1979, 1980, and 1981. In 1981, although volume generally increased, the share of export shipments through these ports began to decline as coal buyers and exporters sought less congested outlets and other ports, notably the Lower Mississippi River ports, Philadelphia, Mobile, and Los Angeles/Long Beach.

Capacity expansion

Many U.S. firms have recently enlarged existing terminals and built new ones. As of January 1983, the U.S. export terminal capacity for steam and met coal was 317.3 million tons per year, an increase of 100.4 million tons over 1981, and additional capacity is planned or under construction.

Table 11

Recent Increases in Coal Port Capacity

Coast	January 1981	January 1983	Increase
	---millions of tons annually--		
East	91.9	120.9	29.0
Gulf	47.5	110.0	62.5
Great Lakes	70.5	79.4	8.9
West	7.0	7.0	-
Total	216.9	317.3	100.4

New coal export terminals under construction will increase the throughput capacity by 56.5 million tons a year. Additional terminal projects totaling 297.6 million tons a year are still planned, although some are now deferred and may never be built.

New terminals oriented to steam coal

Most of the new terminals are being built by coal producers and exporters and have been designed to provide on-the-ground coal storage as opposed to existing east coast terminals which store coal in rail cars.

Existing coal terminals in 1980-81 at Hampton Roads, Baltimore, and Philadelphia were all owned by the railroads serving those ports. They were designed to handle metallurgical coal, which must be blended to customer specifications. To meet the

needs of various customers, sometimes as many as 30 types of coal from different mines were on hand. Coal stored in railroad cars could be moved easily from segregated sections of the railyard then dumped in a predetermined sequence into the ship.

New terminals built and planned by coal companies feature ground storage, which is less expensive and more suited to steam coal that needs less blending than metallurgical coal. Ground storage also allows unit trains to deposit coal without delay, which reduces rail costs and eases coal stockpiling.

During the height of the coal export boom, some foreign buyers complained about the quality of the coal being shipped, which was manually sampled from the top of a railroad car, truck, or barge. More sophisticated quality control methods are now being installed in the new terminals and existing facilities are being retrofitted with automated sampling equipment to sample coal as it moves along a conveyor belt.

PORT DREDGING

Although the majority of the existing bulk carrier fleet are vessels of 80,000 dwt or less, the trend in ocean shipping of bulk cargo, such as coal, is toward larger, more efficient ships of over 100,000 dwt. In 1974, only 6 percent of the world bulk traffic was carried in these larger ships. By 1979, ships of 100,000 dwt or larger carried 26 percent of the traffic. According to the Office of Technology Assessment, as of January 1981 bulk and combination carriers of 100,000 dwt and up made up about 29 percent of the existing fleet and about 37 percent of new vessels of that type on order.

Since distances over most of the world's coal trade routes are long and ocean transportation comprises a significant percent of total delivered costs of imported coal, efforts to significantly reduce the shipping costs should improve the price competitiveness of U.S. steam coal exports.

A December 1980 Maritime Administration study showed that the average daily cost per ton of operating a 100,000 dwt ship was about 23 percent less than operating a 60,000 dwt ship, when the daily fuel and vessel expenses and capital costs were considered.

U.S. exporters generally are not able to take advantage of the cost savings of the larger ships, because no U.S. coal port is deep enough to fully load a bulk carrier of over 80,000 dwt. Only Hampton Roads and Los Angeles can fully load ships of about 80,000 dwt. The rest are limited to the smaller Panamax class ships, so called because they can go through the Panama Canal.

Estimated dredging costs and benefits

Dredging one or more U.S. ports to sufficient depths to accommodate the larger ships has been proposed and studied. Table 12 shows the estimated costs of dredging major U.S. coal ports.

Table 12

Proposed Dredging Projects of Selected U.S. Ports

Port	Depth in feet		Estimated cost[a]	
	Existing	Proposed	Federal	Local
			—(000 omitted)—	
Mobile	40	55	$370,059	$36,057
Los Angeles/Long Beach	55-60	80	460,000+	
Savannah	38	40+	30-80,000+	
Lower Mississippi	40	55	421,000	204,000
Baltimore	42	50	334,000	86,000
New York City:				
Kill Van Kull Channel Newark Bay	34	40	178,400	50,600
New York Harbor and adjacent channels	45	60	570,000	
Hampton Roads	45	55	428,500	51,500

[a]Does not include the annual maintenance dredging costs.

Source: U.S. Army Corps of Engineers.

The Army Corps of Engineers has estimated benefit-to-cost ratios ranging from 2:1 to 9:1 for the major port dredging projects it has studied. If these ratios are correct (and it should be noted that they are based upon pre-1981 data that do not reflect the large increase in U.S. coal exports), the benefits would far outweigh the costs. The major potential benefit cited was reduced transportation costs for all deep-draft ships, including grain, sugar, petroleum, and ore carrying vessels.

It should be noted that other major coal-exporting countries have launched deep-water coal port development programs.

--South Africa can load ships of 160,000 dwt and by 1985 is expected to be able to load ships of 250,000 dwt.

--Australia has four ports capable of loading ships over 100,000 dwt capacity and another scheduled for completion in 1983. Programs are underway at two other ports to handle ships of nearly 200,000 dwt. Additional sites to handle vessels up to 250,000 dwt are being studied.

--Canada has a port on each coast which can load ships of over 100,000 dwt capacity and is developing another on the west coast.

The ability to load such large vessels is of little value, however, if the receiving ports cannot accommodate them. This was an argument that we heard frequently in the United States as various individuals told us that most coal-importing countries do not have deep-water ports and many foreign buyers prefer to receive coal in vessels of under 80,000 dwt. On the other hand, some coal importing countries already are receiving coal in vessels over 100,000 dwt and are dredging additional ports, as shown in table 13.

Many projects have been proposed to dredge existing U.S. coal ports or develop new ones to accomodate ships of 100,000 dwt or more. However, most of these projects depend upon Federal funding for major channel dredging and cannot proceed without it.[1] Furthermore, the three major U.S. east coast coal ports have physical depth limitations--Philadelphia harbor has a rock bottom and the main channels of both Baltimore and Hampton Roads cross major highway tunnels, which limits their maximum potential depths to 50 and 55 feet, respectively, unless the highway tunnels are moved.

For decades, the Federal Government has financed new dredging of ports and waterways, but now the executive branch advocates reimbursement of Government expenditures by those who use the ports through a system of user fees.

Regardless of the Government's funding effort, completion of such projects involves a considerable amount of time. Thus, dredging will probably have little bearing on the export of steam coal in the near- or mid-term.

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[1]A project to dredge the Port of Baltimore to 50 feet from its current 42 feet was authorized by the Congress in 1970, but funds have never been appropriated.

Table 13

Importing Countries' Current Coal Ports

Country	Number of coal ports	Ports able to receive ships over 100,000 dwt		
			Dredging	
		Current	Underway	Planned
Belgium (note a)	5	1	1	1
Denmark (note a)	27	None	2	None
Finland	11	None	2	None
France (note a)	18	3	3	None
Greece	4	None	None	None
Ireland	7	None	1	None
Italy (note a)	25	1	1	4
Netherlands (note a)	9	1	None	2
Norway	22	2	None	None
Portugal	3	None	None	None
Spain (note a)	18	None	2	2
Sweden	20	None	1	None
Turkey	7	None	None	None
United Kingdom	6	2	None	None
West Germany (note a)	17	None	1	None
Japan (note a)	39	16	None	4
Philippines	6	1	None	None
South Korea	10	[b]1	3	1
Taiwan	4	None	None	3
Brazil	6	2	None	None
Total	264	30	17	17

[a]Major importers.

[b]Outer harbor only.

Alternatives to dredging

Alternatives to dredging have also been suggested, but many would require development of costly facilities. The suggested alternatives include

--offshore loading;
--ultra-wide, shallow-draft ships;
--coal slurry ports;
--barge carrying ships;
--ship flotation devices; and
--a coal transshipment facility at the Panama Canal.

Offshore loading of larger ships at anchor in deep water from barges or smaller ships is perhaps the most feasible of all the proposals, since it is already being used in various forms. For example, U.S. coal exported through the Great Lakes ports is carried through the St. Lawrence Seaway in self-unloading "laker" vessels which rendezvous with deep-draft colliers in the Gulf of St. Lawrence. Stevedoring companies in the Lower Mississippi River area transfer coal from river barges to ocean-going ships in midstream by using floating cranes; this is called "midstream transfer." Variations of this alternative, which use floating deep-water terminals supplied by barges to load deep-draft ships offshore, have also been proposed for the lower Delaware River.

Several companies have proposed building coal ships wider than conventional vessels so they could carry more weight per foot of draft. A Japanese company is constructing such a vessel and claims a significant reduction in per unit transportation costs. Although the U.S. Maritime Administration has found that such vessels are technologically feasible, it concluded that they would be less fuel-efficient than conventional deep-draft ships, and cost more to construct. Wide ships also would require modification of port loading facilities.

Coal slurry loading ports could use technology similar to oil loading with an offshore loading point, but would probably require decanting facilities to remove the water from the coal before or after loading.

The concept of towing barges to deep water and putting them fully loaded onto a large carrier ship has been proposed. At the receiving end, the barges would use inland canals and waterways to deliver coal. While the concept offers the advantages of reduced handling of the coal and speed of operation, the empty spaces between barges and decks would be an inefficient use of the carrier ship and the weight of the barges would also have to be transported.

The idea of using a flotation device similar to that used to raise sunken vessels to provide the necessary lift to get fully loaded larger ships out of shallow water ports has been advanced. A U.S. company plans to have such a system operational by late 1984. If successful, it could greatly reduce the need for dredging or reconfiguring terminals for ultra-wide ships.

A coal transshipment facility has been proposed for the Pacific coast of Panama, which would receive coal from ships from the U.S. east and Gulf coasts and load super colliers bound for Pacific Rim markets. The facility would eliminate the need for large ships to sail around Cape Horn. Proposed capacity is about 10 million tons per year. Savings in transportation costs were estimated at $6 per ton. Initial development of the facility has recently been deferred, however, perhaps until 1990.

MAJOR IMPORTERS OF U.S. STEAM COAL (1975-1982)

Region/country	1975	1976	1977	1978	1979	1980	1981	1982
	(thousands of net tons)							
Canada	9,597	9,198	10,587	9,275	11,635	10,762	12,043	13,304
Latin America:								
Argentina	-	-	-	21	-	-	-	-
Brazil	-	-	-	6	24	82	62	-
Chile	-	-	-	-	45	530	42	-
Mexico	100	35	61	35	49	80	114	44
Peru	-	-	-	-	28	-	29	27
Surinam	31	32	-	-	-	-	-	-
Venezuela	-	-	-	2	2	-	26	-
Other	1	-	-	-	-	-	-	7
Total	132	68	61	64	148	692	273	78
Asia and the Pacific:								
China	-	-	-	-	-	-	64	66
Hong Kong	-	-	-	-	-	-	-	91
Japan	-	-	-	172	414	1,039	3,941	3,402
South Korea	-	-	-	-	-	68	292	158
Pakistan	-	-	-	-	-	-	59	60
Taiwan	-	-	-	-	-	584	2,364	1,654
Thailand	-	-	-	-	-	-	-	34
Singapore	-	-	-	-	-	-	-	-
Other	-	-	-	-	-	-	-	1
Total	-	-	-	172	414	1,691	6,720	5,466
Europe:								
EEC								
Belgium/Luxembourg	-	-	-	-	171	1,368	1,180	1,234
Denmark	-	34	99	-	102	1,495	3,332	2,749
France	1,376	949	-	-	184	3,023	4,606	4,785
Germany, West	1,939	429	371	-	696	807	2,253	1,338
Greece (note a)					-		84	344
Ireland	-	-	-	26	121	175	194	176
Italy	83	-	-	11	-	999	3,394	3,641
The Netherlands	-	881	468	36	68	1,895	3,739	2,883
United Kingdom	1,000	68	182	-	38	2,045	644	203
Total EEC	4,398	2,361	1,120	73	1,380	11,807	19,426	17,353

Region/country	1975	1976	1977	1978	1979	1980	1981	1982
Non-EEC								
Albania	-	-	-	-	-	-	-	23
Austria	2	-	-	-	-	-	-	-
Finland	-	-	-	-	-	257	1,211	652
Germany, East	-	-	-	-	48	9	-	-
Gibraltar	-	-	-	-	-	-	46	-
Greece (note a)	-	-	-	-	-	5	-	-
Norway	-	-	-	-	-	-	209	238
Portugal	-	-	-	-	5	27	66	148
Romania	-	-	-	-	-	455	684	147
Spain	-	-	-	-	241	1,069	3,267	2,688
Sweden	-	-	-	-	-	5	101	437
Switzerland	33	14	17	-	-	-	923	-
Turkey	-	-	-	-	-	-	-	124
Yugoslavia	-	-	-	-	-	-	38	-
USSR	-	-	-	-	-	-	-	-
Total Non-EEC	35	14	17	-	294	1,827	6,545	4,457
Total Europe	4,433	2,375	1,137	-	1,674	13,634	25,971	21,810
Middle East	-	-	43	-	-	-	-	70
Africa:								
Algeria	-	-	-	-	-	-	-	-
Egypt	-	-	-	-	241	-	-	-
South Africa	-	-	17	-	-	-	-	-
Total	-	-	17	1	241	-	-	-
Other	1	1	19	1	2	1	1	-
TOTAL	14,163	11,641	11,864	9,585	14,115	26,780	45,008	40,728

[a]Greece became a member of the EEC effective Jan. 1, 1981.

Source: 1975 to 1977 - International Coal 1980, NCA, 1982.
1978 to 1982 - Bureau of the Census.

ESTIMATED INTERNATIONAL RECOVERABLE RESERVES OF COAL, 1979

Area and country	Anthracite and Bituminous		Lignite	
	Recoverable	Portion coking quality	Recoverable	Total recoverable
	(billions of short tons)			
North, Central, and South America:				
Canada	4.18	1.40	2.33	6.51
United States	219.20	41.35	26.90	246.10
Other	5.74	1.52	(a)	5.74
Total	229.12	44.27	29.23	258.35
Western Europe:				
West Germany	26.45	15.87	38.75	65.19
Turkey	0.20	0	1.90	2.11
United Kingdom	49.60	18.35	0	49.60
Yugoslavia	1.73	0	16.53	18.27
Other	1.78	(b)	2.37	4.15
Total	79.76	na	59.55	139.32
Eastern Europe and USSR:				
Bulgaria	0.03	0.02	4.08	4.11
Czechoslovakia	2.98	na	3.15	6.13
East Germany	0.11	na	27.56	27.67
Hungary	0.25	na	4.41	4.66
Poland	29.76	0	13.23	42.99
USSR	160.94	57.32	95.90	256.84
Other	0.05	0	4.21	4.26
Total	194.12	na	152.54	346.66
Africa:				
Botswana	3.86	0	0	3.86
South Africa	27.88	0.83	0	27.88
Swaziland	2.01	0	0	2.01
Other	2.30	0.51	(a)	2.30
Total	36.05	1.34	(a)	36.05
Middle East, Far East, and Oceania:				
Australia	29.65	12.60	35.76	65.41
China	109.13	40.38	na	109.13
India	13.90	4.31	1.75	15.65
Other	3.68	0.62	0.91	4.59
Total	156.36	57.91	na	194.78
WORLD TOTAL	695.41	na	na	975.16

[a]Less than 5 million tons.

[b]Not all countries in this group reported under this category.

Source: Energy Information Administration, Annual Report to the Congress, 1981.

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