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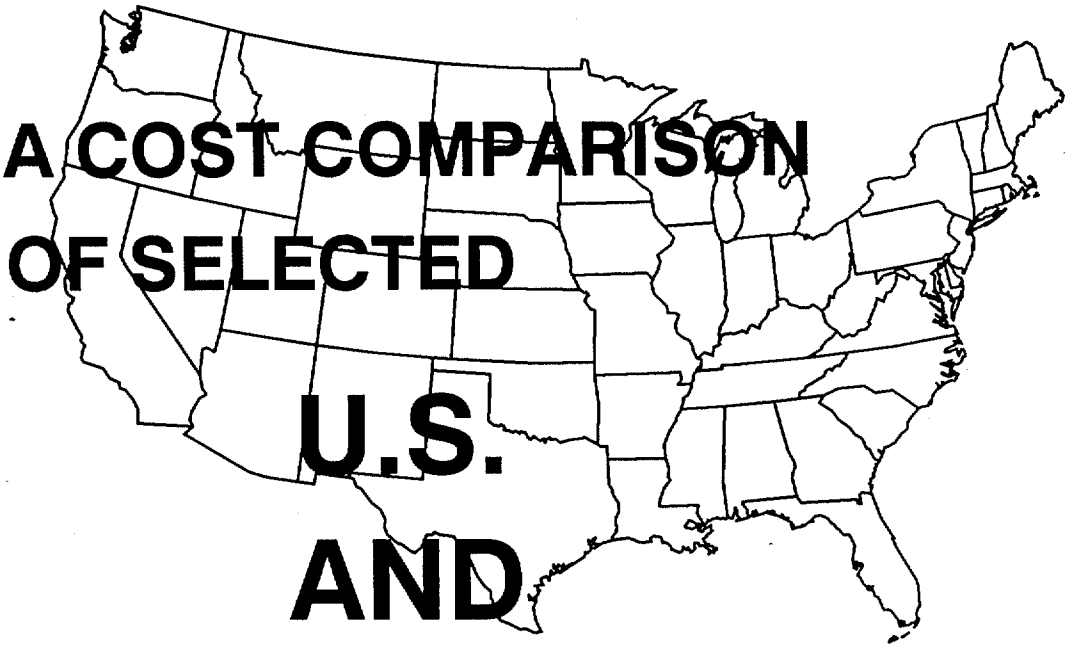
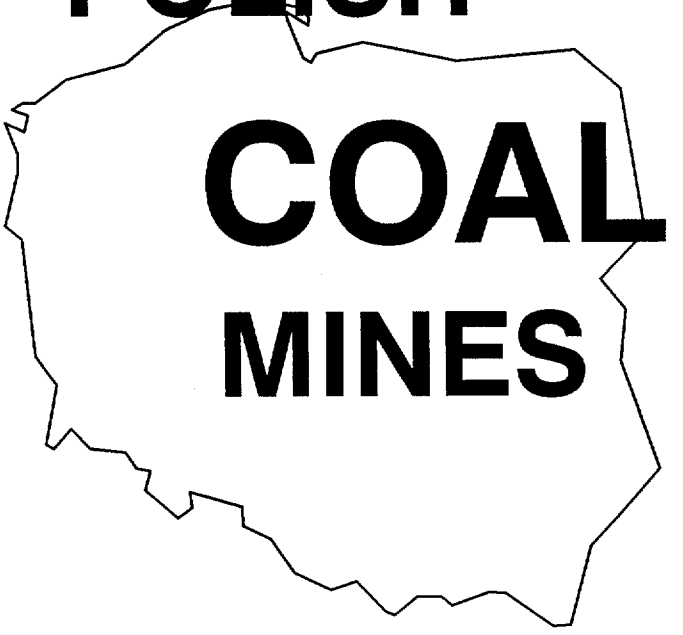


A COST COMPARISON OF SELECTED U.S. AND POLISH COAL MINES



U.S. DEPARTMENT OF THE INTERIOR
U.S. Bureau of Mines

U.S. DEPARTMENT OF COMMERCE
International Trade Administration

A COST COMPARISON OF SELECTED U.S. AND POLISH COAL MINES

PREPARED BY:

U.S. DEPARTMENT OF COMMERCE
International Trade Administration
Energy Division
Office of Energy, Environment, and Infrastructure

AND

U.S. DEPARTMENT OF THE INTERIOR
U.S. Bureau of Mines
Division of Resource Evaluation

August 1993

Library of Congress Cataloging-in-Publication Data:

A Cost comparison of selected U.S. and Polish coal mines /
U.S. Department of Commerce, International Trade Administration
[and] U.S. Department of the Interior. Bureau of Mines.
p. cm. -- (Special publication)
1. Coal trade--Poland--Costs. 2. Coal trade--United States--Costs. 3. Coal--Taxation--Poland. 4. Coal--Taxation--United States. 5. Coal mines and mining--Law and legislation--Poland--Compliance costs. 6. Coal mines and mining--Law and legislation--United States--Compliance costs. I. United States. International Trade Administration. II. United States. Bureau of Mines.
III. Series: Special publication (United States. Bureau of Mines)
HD9555.P62C67 1993
338.2'324'0973--dc20

93-21479
CIP

United States Department of the Interior

BUREAU OF MINES
WASHINGTON, DC 20241-0002

March 10, 1994

Dr. Edvard Markeset, P.E.
Office of Energy, Environment and Technology
AID/NIS/TF/EET, Room 2637
U.S. Department of State
Washington, D.C. 20523

Dear Dr. Markeset:

Enclosed please find a copy of "A Cost Comparison of Selected U.S. and Polish Coal Mines." Four previous country reports were on the coal industries in Colombia, Canada, Australia, and South Africa. A brief synopsis is also attached.

As in previous reports, this study identifies the factors that account for differences in mining costs between comparable coal mines in Poland and the United States. It also examines the relative competitiveness of selected Polish and U.S. coal mines supplying similar quality coals to specific domestic and overseas markets.

Comments on the report are encouraged. If you have any comments or questions, please contact me at (202) 501-9751, or fax your comments to (202) 219-3044.

Sincerely,

Charles L. Oddenino II

Charles L. Oddenino II
Program Manager

Enclosures

C

A COST COMPARISON OF SELECTED U.S. AND POLISH COAL MINES

Synopsis

This report on the Polish coal industry is the fifth in a series of studies on coal exporting countries requested by the House Appropriations Committee. The committee requested that the basic differences in mining costs for U.S. and foreign mines be identified, especially those costs incurred in complying with health, safety and environmental regulations.[1] Basic costs in extracting raw coal are analyzed in this report for underground longwall mining operations. It also contains a competitive analysis of delivered costs in the electric utility and metallurgical coal markets in Western Europe.

In the basic mining cost comparison, eight Polish longwall operations are compared with three U.S. longwall operations. While the mining methods are generally similar, it should be noted that the Polish mines use the European single-entry longwall system, while the U.S. mines use a multiple entry system. The Polish mines were found to have a basic mining cost advantage of $5.60/metric ton raw coal. In general, the Polish mines have lower operating and land costs, and higher capital and tax costs than the U.S. mines.

Capital costs for the Polish mines appear to be higher because of low productivity, and more frequent replacement of the Polish face equipment than is typical in the U.S. mines. Capital costs accounted for 19 to 50 percent of the total Polish costs and 7 to 18 percent of the total U.S. costs.

The lower mine operating costs (labor plus consumable equipment and supplies) of the Polish mines are due mainly to much lower wage rates (wage scales range from approximately 8 to 11 percent of U.S. wages depending on whether the job classification is unskilled, skilled or supervisory). However, the U.S. mines have much higher labor productivity (2.7 to 3.0 tons/person hour) than the Polish mines (0.3 to 0.7 tons/person/hour).

The results of the regulatory cost analysis show that U.S. mines have generally higher health, safety, and environmental regulatory costs if the productivity penalty is included. The productivity penalty is amount of increased operating costs caused by health, safety and environmental regulations. The productivity penalty is basically the cost of altered work practices, such as time spent testing for methane and hanging ventilation brattice cloth. If the estimated U.S. productivity penalty is not considered, Polish regulatory costs are comparable to those in the United States, ranging from $0.59 to $1.67/metric ton of raw coal for the Polish mines and $1.09 to $1.25/metric ton for the U.S. mines.

For the European steam and metallurgical coal market comparisons, both underground and surface mining operations in the United States are compared with the underground longwall mines in Poland. The results illustrate the geographic advantage of the Polish mines to equate to a minimum transportation cost advantage of $6.60/metric ton which enables them to be competitive with U.S. mines in these markets.

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[1] H.J. Resolution 648, House Appropriations Committee Report 98-1030, United States Congress. Other country studies completed include cost comparisons with Colombian, Canadian, Australian,and South African coal mines.

FOREWORD

This report is the joint effort of the Energy Division, International Trade Administration, Department of Commerce, and the Division of Resource Evaluation, U.S. Bureau of Mines, Department of the Interior.

The study is the fifth of coal exporting country reports to fulfill the second part* of a two-part congressional directive to analyze the potential for increased imports of steam coal into the United States. In its report 98-1030 accompanying the Continuing Resolution for FY 1985 (H.J. Res. 648), the House Appropriations Committee stated:

> In recent years, several foreign countries, most notably Colombia, have expanded their coal marketing in the United States.
>
> In view of the fact that such coal imports seriously threaten American coal sales, the Committee calls upon the Secretary of Commerce, working in consultation with the Secretary of Energy, to conduct a comprehensive study of the current and long-range impact of expanded coal marketing by these foreign countries. This study should include an analysis of potential market penetration and the impact on coal employment and American coal exports.
>
> * In addition, this study should include a full report comparing the conditions in these foreign mines, including worker safety, wage rate, and environmental protection, with American regulations and standards.

Special thanks are given to the Polish State Coal Agency, Centralny Osrodek Infomatyki Gornictwa (COIG), the Polish Academy of Sciences, and the individual coal mines in Poland and the United States that participated in this study. This study would not have been possible without the cooperation of these parties.

Questions and comments on this report are welcomed. These should be directed to the principal author, Charles Oddenino, Division of Resource Evaluation, MS 5202, U.S. Bureau of Mines, 810 Seventh Street, NW, Washington, DC 20241. Telephone (202) 501-9751.

Previous country reports in this series include cost comparisons of U.S. and Colombian, Canadian, Australian, and South African coal mines. Copies of these reports may be obtained by contacting the author of this report.

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EXECUTIVE SUMMARY

Introduction

This report on the Polish coal industry is the fifth in a series of studies on coal exporting countries requested by the House Appropriations Committee. The committee requested that the basic differences in mining costs for U.S. and foreign mines be identified, especially those costs incurred in complying with health, safety, and environmental regulations.[1] Other country studies completed include cost comparisons with Colombian, Canadian, Australian, and South African coal mines.[2] Basic costs in extracting raw coal are analyzed in this report for underground longwall mining operations, the only mining method employed in Poland for hard coal.

In this report there is also a limited analysis of the relative market competitiveness of selected Polish and U.S. steam and metallurgical coal mines in the European electric utility and metallurgical coal markets.

At the time this report was prepared, all coal resources in Poland were owned by the state and exploited by state-owned companies. All hard coal is produced using the underground, single entry longwall method commonplace in Europe. Coal production is highly mechanized, but a much higher percentage of semiskilled workers is employed compared to the U.S. industry.

The Polish coal industry is regulated by the Central Government. Regulations cover coal resource management; exploration; health, safety, and environmental standards; taxation; transportation; and exports. In January 1990, the Government stopped setting domestic coal prices. However, limits on price increases are still imposed on coal producers by the Finance Ministry through the local tax district offices. Export prices are determined by market competition.

In January 1990, the Polish Government also revalued its currency, fixing its initial value at approximately 9,500 zlotys

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[1] H.J. Resolution 648, House Appropriations Committee Report 98-1030, United States Congress.

[2] The U.S. Bureau of Mines and the Department of Commerce have jointly published four previous coal cost comparison studies: A Cost Comparison of Selected U.S. and Colombian Coal Mines, (January 1986); A Cost Comparison of Selected U.S. and Canadian Coal Mines, (April 1988); A Cost Comparison of Selected U.S. and Australian Coal Mines, (April 1989); and A Cost Comparison of Selected U.S. and South African Coal Mines, (April 1990).

per U.S. dollar. The 1990 coal production costs calculated by the Polish authorities showed little difference when expressed in terms of U.S. dollars, but showed a large increase in the costs and prices when expressed in terms of Polish zlotys. The average cost of salable coal production for Polish mines in 1989 and 1990, expressed in U.S. dollars, was $20.98 and $19.39 per metric ton of salable coal, respectively.[3]

The devaluation of a currency will not necessarily benefit an individual mine or industry if the capital structure has either debt or equity denominated in foreign currency. If capital was denominated in foreign currency, then exchange rate movements can either improve or worsen its international competitiveness depending on the currencies involved and the exact capital structure. Because the Polish Central Government owns the mines, and much of their external debt is denominated in foreign currencies such as the dollar, there exists a need to continue exports to generate needed foreign exchange to repay the debts. Coal is generally a commonly traded, fungible commodity for which there is an established international market. Because of this, Polish coal exports will probably continue, despite whatever problems that may exist.

Because the costs and prices of Polish coal in 1989 and 1990 were relatively stable in terms of U.S. dollars (the currency used in this cost comparison report), the decision was made to report on the cost structure of Polish coal mines as it existed in 1989, if for no other reason than to establish baseline data on the Polish coal industry. All costs in this report, including the individual mine-mouth costs and inland and ocean transport costs, are in 1989 U.S. dollars per metric ton. Furthermore, we recognize that the structural cost of mining in Poland may change rapidly in the coming years as the industry undergoes the transformation from a socialist system of operation to that of a market-oriented system. The results of this report should be viewed as a snapshot in time, as the current state of flux in the Polish coal industry could quickly make the findings obsolete.

In 1989, Poland produced 178 million metric tons (Mmt) of salable coal, of which 29 Mmt was exported.[4] Most of the total production, about 152 Mmt, was steam coal, while 23 Mmt was coking coal. In 1989, Poland ranked fifth in the world in hard coal production. It ranked seventh in proven recoverable coal reserves with approximately 2.5 percent of the world's total

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[3]Zestawienie Wskaznikow Technicno-Ekonomicznych Kolpaln Za Rok 1989, and Zestawienie Wskaznikow Technicno-Ekonomicznych Kolpaln Za Rok 1990, Centralny Osrodek Informatyki Gornictwa.

[4]Metric tons are used throughout this report unless noted otherwise.

recoverable coal reserves.[5],[6] By 1990, falling production (148 Mmt) had caused Poland to be ranked seventh in hard coal production.

Coal exports prior to 1990 were controlled through Weglokoks, the state coal export sales company. Individual coal mines may now apply for and receive licenses for export from the Central Government, although most exporting mines have signed multiyear marketing contracts with Weglokoks.

Poland is the sixth largest coal exporter ($968 million in coal sales in 1990) and supplies about 8 percent of all coal in world trade. Its most important markets are Western Europe, Eastern Europe, the Commonwealth of Independent States (the former Soviet Union), and Brazil.

The eight Polish bituminous coal mines examined for this study are in Upper Silesia (the Gornoslaskie coal district), the major coal producing area. Seven of the mines export part of their coal production. The Polish mines are compared to similar coal mines in the United States. The U.S. mines are in the central and southern Appalachian coal producing regions. Most of the U.S. mines were developed to serve the export market. To ensure confidentiality, the mines are not identified, and individual mine cost data are aggregated.

Summary of General Findings

The general findings in this study support the prevailing views in international coal trade relative to the cost of mining coal in Poland and its competitiveness in world coal markets.

Polish mines have lower mine operating and land costs than comparable mines in the United States. Capital and tax costs for Polish mines, however, appear to be significantly higher than comparable mines in the United States.

Although the U.S. mines have consistently higher productivity than their counterpart mines in Poland, wage rates and total labor costs in the United States are much higher. The high productivity in the U.S. mines generally does not offset the higher wages paid. The labor wage rates in U.S. mines average about 10 times higher than for comparable mines in Poland. In Poland, mine wages are negotiated with the unions and reflect prevailing economic conditions and the value differences between

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[5]Coal Information 1992, International Energy Agency, Organisation for Economic Co-operation and Development, 1992.

[6]International Energy Annual, 1990, Energy Information Administration, U.S. Department of Energy.

unskilled and skilled employees. The majority of Polish coal miners belong to, and are represented by, a trade union.

Land costs in Poland were nonexistent in 1989 because the mines paid no royalty to the state for the coal rights. Proposed legislation in Poland would institute a concession system whereby the mine would pay a license or lease fee for the right to mine coal. In the United States, most mines pay royalties and lease fees to private, State, or Federal owners of the land and coal. These costs ranged from 0 to 5 percent of the total basic mining costs in the study.

Tax costs, penalties, and other Government charges for the Polish mines are generally higher than those for the U.S. mines. The tax charges in Poland that account for most of the differences are income taxes, subsidence assessments, environmental protection penalties, and miscellaneous charges for patent fees and technology transfers, etc. At positive rates of return, Poland's higher income tax, which is 40 percent compared to the U.S. maximum rate of 34 percent, causes a dramatic increase in tax charges. The difference in income tax rates also amplifies the generally higher capital costs of the Polish mines.

The major differences in the regulatory costs that were analyzed in this study are the estimated productivity penalty calculated for the U.S. mines and the U.S. black lung tax. While the Polish industry probably incurs a productivity penalty for adhering to health and safety regulations, the loss could not be quantified by Bureau personnel. Reclamation fees, environmental penalties, subsidence assessments, and health and safety costs (primarily training) in the mines are all tabulated in the Polish cost accounting system and reported in this study. If the U.S. mines' productivity penalty is ignored, regulatory costs appear to be similar for Polish and U.S. underground mines.

Poland's low labor and materials costs result in a competitive cost advantage in world coal markets. However, these low operating costs are offset by higher capital costs.

A modern railroad system from Upper Silesia to the main coal export facilities at Swinoujscie and Gdansk North Port provides efficient transportation service. The rail haulage distance to port is from 20 to 40 percent less than typical mine-to-port distance in the United States. Average U.S. rail transport costs for export coal are typically 2.5 times higher than in Poland.

Geographic location with respect to an overseas consumer is an important competitive cost factor. Polish mines have a sizable ocean freight cost advantage over U.S. competitors in serving European country consumers.

The findings from these cost-competitive market case studies are time dependent. Relative cost competitiveness can change quickly for a variety of reasons. Major cost factors subject to change are currency exchange rates relative to competing coal exporting countries, ocean freight rates, and Government policies. Unlike previous countries studied, Poland is also experiencing rampant inflation, a rapidly changing labor environment, and a great deal of uncertainty regarding Government policies toward taxation, resource development and royalties, and the privatization of state enterprises.

Study Methodology And Scope

As in the previous country studies, this study uses the case approach. Each case comprises a set of selected Polish and U.S. mines. The basic mining cost (capital, operating, land, and tax) in this study is the average cost to extract 1 ton of raw coal during the remaining life of the mine, which was presumed to be 20 years for the Polish mines. The remaining lives of the U.S. mines used in the analysis ranged from 20 to 30 years. Delivered cost includes the mine-mouth cost (basic mining cost plus coal preparation) and transportation costs. Average mining costs are calculated using a discounted cash-flow rate of return (DCFROR) analysis.[7]

Capital and operating costs are engineering estimates based on evaluations made in 1990 and actual 1989 cost worksheets and asset lists obtained for the Polish operations. All values are expressed in average 1989 U.S. dollars and the corresponding value of the zlotys (Zl 1,446 = US $1.00) unless otherwise noted.

The DCFROR analyses were made at zero and 15 percent discount rates. Zero percent represents a recovery of all costs and invested capital. The average mining cost at 15 percent includes a cost component equivalent to 15 percent return on cash-flow.

Regulatory compliance costs are specific cost items that could be isolated from the normal activities involved in mining coal. These items are specialized health and safety equipment, mandatory training, selected reclamation activities, dust control, and regulatory fees and taxes. All other regulatory-based compliance costs, such as business expenses and mandated operating practices, are included in the operating costs.

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[7]The DCFROR analysis is done using a U.S. Bureau of Mines computer program that calculates the average remaining cost during the life of the mine for specified rates of return on investments.

Results From Basic Mining Cost Case Study

In this study, national differences in the basic cost of mining reflect costs that are inherent within prevailing social, political, and economic conditions in Poland and the United States. To identify these differences, cost comparisons are made among deep longwall mines that have generally similar geologic profiles, mining methods, and production capabilities. Similar coal quality is not required because the objective is to compare the cost of extracting 1 ton of raw coal. Discussion of the main differences in basic cost factors that were found between Polish and U.S. coal mines follows.

Case I, the only case study for the basic mining cost comparison, compares deep longwall operations at eight Polish mines with three U.S. mines. While the mining methods are generally similar, it should be pointed out that the Polish mines use the European single-entry longwall, which uses steel arches to support the panel development entries. Entries are driven using Alpine-Miners, also known as roadheaders. U.S. mines, in contrast, typically develop at least three panel entries along the length of the longwall panel, and continuous miners are used for the development work. Roof bolts are used to stabilize the development entry roof in the U.S. system. Finally, the U.S. mines generally operate in thinner seams than those in the Polish mines.

The basic mining cost ranges are shown in Table I in 1989 dollars per ton. The figures represent the component costs to extract 1 ton of raw coal at zero and 15 percent DCFROR. Only those assets and costs directly pertinent to cost of mining coal are analyzed. Incidental operations carried out by the Polish coal mines, such as the vacation hotels, apartment construction and maintenance, sports facilities, etc., were not considered in this analysis.

The Polish longwall mines have a slight basic mining cost advantage of $5.60/ton at zero percent return and $5.70 at 15 percent return. In general, Polish mines have lower mine operating and land costs, and higher capital and tax costs.

Capital costs for the Polish mines appear to be higher because of low productivity, and more frequent replacement of the Polish face equipment than is typical in the U.S. mines. Capital costs accounted for 19 to 50 percent of the total Polish costs and 7 to 18 percent of the total U.S. costs.

The lower mine operating costs (labor plus equipment and supplies) of the Polish mines are due mainly to much lower wage rates (wage scales range from approximately 8 to 11 percent of U.S. wages depending on whether the job classification is unskilled, skilled, or supervisory). While the U.S. mines have

much higher labor productivity (2.7 to 3.0 tons/person hour), compared with the Polish mines (0.3 to 0.7 tons/person hour), the higher U.S. productivity is not sufficient to compensate for the higher wages paid to U.S. miners.

The cost of equipment and supplies appears to be significantly lower for Polish mines compared with U.S. mines. Overall, mine operating cost represents from 70 to 86 percent of the total cost for U.S. mines and from 30 to 72 percent for the Polish mines.

Tax costs for the Polish mines are generally higher than for the U.S. mines. This finding is more noticeable at higher rates of return because of the generally higher capital costs of the Polish mines and the higher Polish Federal income tax rate. Taxes accounted for 6 to 12 percent of the U.S. basic mining cost and 9 to 25 percent of the total Polish basic mining costs.

TABLE I
Case I: Longwall Mines Cost Comparison
(1989 U.S. dollars per metric ton raw coal)

Cost Category	U.S. Range	Polish Range
At Zero Percent DCFROR		
Capital	1.01 - 2.36	2.17 - 11.72
Operating*	11.88 - 27.44	5.60 - 14.85
Land	0.00 - 0.74	0.00 - 0.00
Taxes and penalties	0.95 - 2.28	1.12 - 3.52
Basic Mining	14.81 - 32.08	9.19 - 26.51
At 15 Percent DCFROR		
Capital	1.80 - 4.30	2.78 - 20.33
Operating*	11.88 - 27.44	5.60 - 14.85
Land	0.00 - 0.79	0.00 - 0.00
Taxes and penalties	1.43 - 4.05	1.64 - 7.81
Basic Mining	15.91 - 34.68	10.12 - 40.35

*Includes labor, equipment, and supplies.

Notes: Totals may not add because they represent the costs at an individual mine. Cost components within a column may be from several different mines to illustrate the minimum or maximum value for each respective cost component among the mines. Exchange rate used is: Zl 1,446 = US $1.00.

The comparison of regulatory compliance costs covers only certain health, safety, and environmental requirements that could be isolated and could have their costs computed. These were mandatory training, productivity losses, equipment modifications, personal equipment and safety facilities, black lung (pneumoconiosis) tax, treatment of water discharge, waste

disposal, environmental penalties, and reclamation fees. No productivity penalty was calculated for the Polish mines, and only those regulatory costs collected and tabulated by the Polish mines in their official cost worksheets were used in this report. The regulatory costs are shown in Table II.

The results of the regulatory cost analysis show that U.S. mines have generally higher health, safety, and environmental regulatory costs if the productivity penalty is included. Without the productivity penalty, Polish regulatory costs are comparable to those in the United States, ranging from $0.59 to $1.67/ton of raw coal for the Polish mines and $1.09 to $1.25/ton for the U.S. mines.

TABLE II
Selected Regulatory Costs For Case I Mines
Zero Percent DCFROR
(1989 U.S. dollars per metric ton raw coal)

Cost Category	U.S. Range	Polish Range
Mine Safety and Health	2.30 - 4.20	0.16 - 0.52
Training/H&S in the colliery	0.04 - 0.10	0.08 - 0.38
Productivity changes	1.32 - 3.06	0.00 - 0.00
Equipment modifications	0.10 - 0.25	0.00 - 0.00
Personal equipment and safety facilities	0.01 - 0.06	0.00 - 0.00
Black lung tax	0.61 - 0.79	0.00 - 0.00
Science and technology tax	0.00 - 0.00	0.07 - 0.14
Environmental	0.09 - 0.11	0.40 - 1.39
Abandoned mine lands/ reclamation fund	0.09 - 0.11	0.00 - 0.04
Subsidence assessments	0.00 - 0.00	0.16 - 1.15
Environmental protection	0.00 - 0.00	0.02 - 0.33
Waste and effluent disposal	0.00 - 0.00	0.18 - 0.38
Total	2.41 - 4.31	0.59 - 1.67

Notes: Total regulatory costs cover only the activities shown, and these costs do not include any indirect costs that are affected by regulation (e.g., Federal income taxes). Totals may not add because they represent the costs at an individual mine. Cost components within a column may be from several different mines to illustrate the lowest to highest value for each respective cost component among the mines. Exchange rate used is: Zl 1,446 = US $1.00.

Results From Competitiveness Case Studies

The relative competitiveness as measured by delivered costs is analyzed for the electric utility and metallurgical coal markets in Western Europe, specifically the United Kingdom. The mines in each country case study were matched for comparable steam coal quality. The metallurgical coal quality was matched only by free swelling index because there were insufficient data on the metallurgical coal to determine whether the coals were well matched on all other quality indices, such as fluidity.

Additional U.S. mines, some with substantially different mining methods and production capacities, were added for the purposes of the delivered cost comparisons.

Competitiveness in international coal trade is difficult to define in explicit terms. Delivered price is a major factor, but other factors, such as consistent quality and reliability of supply, are also important to international buyers. In this study, only the delivered costs are analyzed. The delivered price comprises two major cost components: the mine-mouth cost and the transportation cost. These costs are summarized in Table III for the two cases.

TABLE III
Delivered Cost Comparisons
(1989 U.S. dollars per metric ton salable coal)

Cost Category At Zero Percent DCFROR	U.S. Range	Polish Range
Case II: European Electric Utility Coal Market		
Mine-mouth*	25.30 - 55.73	27.88 - 42.55
Transportation	19.92 - 25.94	12.57 - 13.28
Total Delivered	46.25 - 75.65	40.45 - 55.84
Case III: European Metallurgical Coal Market		
Mine-mouth*	27.20 - 39.96	28.42 - 42.55
Transportation	19.46 - 27.31	11.27 - 12.78
Total Delivered	50.06 - 66.64	39.69 - 55.34

*Includes all capital, operating, land, and tax costs for both the mine and preparation plant.

Notes: Totals may not add because they represent the costs at an individual mine. Cost components within a column may be from several different mines to illustrate the minimum or maximum value for each respective cost component among the mines. Exchange rate used is: Zl 1,446 = US $1.00

The mine-mouth cost is defined as the cost to produce 1 ton of salable coal ready for shipping. Mine-mouth costs at zero percent rate of return are compared because they represent the

break-even point. The gross sales revenue at the mine equal to the mine-mouth cost is sufficient to cover all mining costs and recover the capital investment. At this point, the mine-mouth cost does not contain a return on investment.

Transportation cost is the total cost of delivering the coal to an export terminal, port terminal service charges, and ocean transport to the unloading port terminal. In this study, transportation costs were the prices paid by the shipper and not the costs incurred by the transport or other service companies. The transport modes and routes used in the market case studies conform to normal coal trade practices.

European Electric Utility Coal Market

The electric utility industries in Europe are a growing market for imported steam coal. From a geographical point of view, they are a natural market for eastern U.S. coal exporters. Steam coal imports by European countries are projected to increase from about 80 Mmt in 1989 to 155 Mmt in 2000.[8]

This case study uses five Polish mines and three U.S. mines. The Polish mines are from the same group of eight mines studied in Case I and are all underground longwall operations. The Polish mines ship their coal by rail to either Gdansk North Port or Swinoujscie for export. The individual distances from the mines to the ports range from approximately 511 to 609 kilometers (km), depending on the mine and port of exit. Ocean shipping is via Panamax vessels, and the distance to the United Kingdom port is approximately 2,903 to 2,738 km, depending on whether the ship sails from Gdansk North Port or Swinoujscie, respectively.

The three U.S. mines in this case are located in Kentucky and West Virginia. The U.S. mines use conventional, longwall and surface mining methods. One is an underground mine using the conventional system (drilling, blasting, and loading). Another is a multiple-seam surface operation using a modified mountain-top-removal mining method. The third U.S. mine is an underground longwall operation in West Virginia. Coal from one Kentucky mine is railed approximately 780 km to a terminal in the Hampton Roads area, where it is loaded on Panamax vessels. The shipping distance from Hampton Roads to the United Kingdom receiving port is approximately 6,060 km. The other Kentucky mine rails the coal approximately 83 km to a river terminal, where it is loaded on barges and shipped to a New Orleans coal terminal. The West Virginia mine also ships its coal down the river system to New Orleans. At New Orleans, the coal from both the West Virginia

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[8] Coal Information 1990, International Energy Agency, OECD/IEA, Paris, 1990, pp. 307-308.

and Kentucky mines is loaded into Panamax vessels, and shipped approximately 8,490 km to the United Kingdom receiving port.

The delivered costs for the Polish mines range from $40.45 to $55.84/ton and for the U.S. mines $46.25 to $75.65/ton. In this case, the Polish and U.S. delivered cost ranges overlap considerably, although the Polish costs are generally lower.

The mine-mouth costs for the Polish mines show a general advantage in operating costs, but a distinct disadvantage in taxes and penalty costs. The wide range in mine-mouth costs for the U.S. mines is due to a mix of lower cost surface mines and higher cost underground mines.

Total transportation costs for the Polish mines are consistently lower than U.S. mines. Polish mines enjoy a minimum transportation cost advantage of approximately $6.64/ton. Both the ocean shipping and inland transportation costs for the U.S. mines are higher than those incurred by the Polish mines.

This case illustrates that the Polish mining industry has a distinct geographical advantage, as well as a production cost advantage, in the United Kingdom steam coal market.

European Metallurgical Coal Market

The European metallurgical coal market, like the steam coal market, is a growing market. In 1989, European Community steel mills imported approximately 48 Mmt of metallurgical coal; by 2000, imports are projected to reach approximately 76 Mmt.[9] The European metallurgical coal market is a major market for U.S. metallurgical coal exports; approximately 28 Mmt of U.S. metallurgical coal was exported to Europe in 1989. Many U.S. coal mines were developed specifically to serve this market. In this case, the receiving port is located in the United Kingdom.

This case study uses four Polish mines and four U.S. mines. The Polish mines are part of the group used in Case I. All of the Polish mines rail their coal to Gdansk North Port or Swinoujscie for shipment to the United Kingdom aboard either Panamax or Capesize vessels. The ocean shipping distances from Swinoujscie and Gdansk to the United Kingdom receiving port are approximately 2,360 and 2,630 km, respectively.

The four U.S. mines in this case, all longwalls, include two mines examined in Case I, one each in Virginia and Alabama, and two others: one in West Virginia and another in Alabama. The Virginia and West Virginia mines rail their coal approximately 690 km and 800 km, respectively, to the Hampton Roads area ports

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[9]Work cited in footnote 8.

for shipment aboard either Panamax or Capesize vessels to the United Kingdom receiving port. The shipping distance from the Hampton Roads-Norfolk area to the United Kingdom receiving port is approximately 5,920 km. Both of the Alabama mines barge their coal approximately 650 km to the Port of Mobile. There the coal is loaded into Panamax vessels for the 8,250 km ocean voyage to the United Kingdom receiving port.

The delivered costs for the Polish mines range from $39.69 to $55.34/ton and for the U.S. mines $50.06 to $66.64/ton. In this case, the Polish mines delivering coal to the United Kingdom port have generally lower costs than the U.S. mines.

The total mine-mouth costs for the Polish and U.S. mines in this case are comparable. The Polish mines, while they have generally lower production costs, have a significantly higher tax burden than the U.S. mines. About one-half of the Polish tax burden in this case is the 20 percent export tax used in the study.

Total delivered transportation costs, like the previous case, favor the Polish mines because of the much shorter distance to the consumer. The transportation cost advantage for the Polish mines is approximately $6.70 to $16.00/ton over the U.S. mines. The U.S. transportation costs are 1.7 to 2.4 times as high as those incurred by the Polish mines.

This case illustrates that the geographic advantage of the Polish mines enables them to offset disadvantages caused by higher Polish taxes and, as a result, be competitive in European markets compared with U.S. mines.

CHAPTER 1

INTRODUCTION

This report on the Polish coal industry is the fifth in a series of coal exporting country studies originally requested by the House Appropriations Committee. Previous studies examined the Colombian, Canadian, Australian, and South African coal industries. Congress requested that basic differences in mining costs between U.S. and foreign mines be identified, especially those costs incurred in complying with health, safety, and environmental regulations.[1]

This report compares the basic costs of mining coal among comparable Polish and U.S. mines. Basic mining cost is defined as the cost of producing 1 metric ton of raw coal over the remaining life of the mine.[2] Unit component costs that make up the basic cost are analyzed to identify inherent differences in cost structures. Unit component costs are capital; labor; equipment and supplies; land; taxes; and compliance with selected health, safety, and environmental regulations.

This report also includes a limited analysis of the relative market competitiveness between selected Polish and U.S. coal mines. Electric utility and metallurgical coal markets are examined for Western Europe, specifically the United Kingdom.

Poland is a major coal producer and exporter, supplying steam coal markets in Europe and metallurgical coal markets around the world. It accounts for about 8 percent of all coal in world trade and 10 percent of the world trade in steam coal. Its most important markets are the former Eastern Bloc countries, Europe, and Brazil.

Study Approach

As in previous country studies, the case approach is used. Each case comprises a set of selected Polish and U.S. mines.

Case I examines basic mining costs for similar underground longwall mines in Poland and the United States. Only longwall mines are used to examine basic cost structures, because all hard coal mines in Poland are deep longwall mines. The only surface mines in Poland are lignite mines, which are not studied in this report.

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[1]H.J. Resolution 648, House Appropriations Committee Report 98-1030, U.S. Congress.

[2]Metric tons are used throughout this report unless noted otherwise.

Cases II and III analyze the delivered cost competitiveness (basic mining costs plus preparation and transportation costs) of Polish and U.S. coal mines. Cases II and III examine the electric utility steam coal import market and the metallurgical coal import market in the United Kingdom, respectively. Additional U.S. mines using mining methods other than underground longwalls are used in these cases, since the objective is to examine the competitiveness of typical operations that export coal.

Methodology

The methodology for calculating the average basic mining cost over the life of the mine is identical to that employed previously in the study of other foreign coal mines.[3] Chapter 3 of this report contains a brief explanation of the engineering costing procedures and the discounted cash flow analysis used to calculate the average basic mining cost. Appendix D (available separately from the author) has a more detailed explanation.

In the cost competitiveness cases, point-to-point transportation costs are estimated prices paid by the shipper, and not the costs incurred by the transporter.

Scope of Study

The eight Polish coal mines in this study are located in the Upper Silesia Basin, the major hard coal producing region in Poland. The mines produce subbituminous and bituminous coal of varying steam and coking quality characteristics. Seven of the eight Polish mines export significant quantities of coal. The U.S. mines in this study are located in the Appalachian coal producing regions. These mines were initially developed to supply export metallurgical coal markets.

To secure the cooperation of the Polish and U.S. coal companies, it was agreed that the mines would not be identified and that individual mine cost data would be aggregated to ensure confidentiality of certain cost figures.

Polish mines in Case I of this study are eight underground mines using single-entry longwall methods, mining multiple coal seams with annual raw coal production ranging from 1.4 to 9.5 million tons. The U.S. mines in Case I of this study are three

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[3] A Cost Comparison of Selected U.S. and South African Coal Mines, U.S. Department of Commerce, International Trade Administration, and the U.S. Department of the Interior, U.S. Bureau of Mines, April 1990. Similar reports on the Colombian, Canadian, and Australian coal industries were published in 1986, 1988, and 1989, respectively.

underground bituminous coal mines using multiple development entry longwalls, mining one seam with annual raw coal production ranging from 1.5 to 2.4 million tons.

In calculating the costs of compliance with health, safety, and environmental regulation, it was assumed that the mines fully met the minimum regulatory requirements. Site visits to U.S. and Polish mines were not made for the specific purpose of verifying regulatory compliance.

Caution should be used in comparing the basic mining and market-specific delivered costs in this report to current mine-mouth or market prices. Mining costs in this study are averages over a 20 year period during the life of a mine and may not reflect the actual cost at any one time during a mine's life. In addition, the delivered costs may not include marketing, sales, and other corporate overhead charges.

It is also important to recognize that transportation costs in this report may not be representative of current market rates. Both inland and ocean freight spot shipment rates may differ from contract rates or charter rates. Further, ocean freight rates can be extremely volatile, as they respond to both cyclical and sudden changes in demand and supply of bulk freighters.

Another reason to use caution in interpreting the costs in this report is that the engineering cost evaluations in this study are based on mine operating conditions in 1989 and the U.S. dollar value of the operations after conversion from Polish zlotys. The exchange rate used was an approximate average rate of Zl 1,446 = US $1.00. Exchange rates were controlled entirely by the Government in 1989.

In January 1990, the Polish Government revalued its currency, fixing its initial value at approximately Zl 9,500 = US $1.00. This action had minimal effect on the costs and price of Polish coal when expressed in terms of U.S. dollars, but showed a large increase in the costs and prices when expressed in terms of Polish zlotys. The average cost of salable coal production for Polish mines in 1989 and 1990, expressed in U.S. dollars, was $20.98 and $19.39/metric ton (mt) of salable coal, respectively.[4]

Because the costs and prices of Polish coal were relatively stable in terms of U.S. dollars (the currency used in this cost comparison report), the decision was made to report on the cost structure of Polish coal mines as it existed in 1989. All

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[4]Zestawienie Wskaznikow Technicno-Ekonomicznych Kolpaln Za Rok 1989, and Zestawienie Wskaznikow Technicno-Ekonomicznych Kolpaln Za Rok 1990, Centralny Osrodek Informatyki Gornictwa.

costs—including the individual mine-mouth costs and inland and ocean transport costs—are in 1989 U.S. dollars per metric ton.

Furthermore, we recognize that the structural cost of mining in Poland may change rapidly in the coming years as the industry undergoes the transformation from a socialist system to a market-oriented system.

Organization of Report

Chapter 2 is an overview of the Polish coal mining industry.

Chapter 3 compares the basic costs of extracting raw or run-of-mine coal by the underground longwall mining method.

Chapter 4 examines the competitiveness of selected mines in specific world markets.

The glossary contains definitions and explanations of the nomenclature used in this report.

Appendices A and B give detailed descriptions of applicable Federal and State tax and other Government charges in Poland and the United States, respectively.

Appendix C is a detailed description of the hard coal producing areas in Poland, including their producing mine details, and a brief summary of Polish regulatory and tax regimes.

Appendix D details the study methodology. Appendix E is a summary of the main U.S. coal mining laws. Copies of these appendices are available from Charles Oddenino, Program Manager, U.S. Bureau of Mines, (202) 501-9751.

CHAPTER 2

OVERVIEW OF THE POLISH COAL INDUSTRY

Introduction

In this chapter, the Polish coal industry is briefly described. Discussed are Poland's role in world coal production and trade and its relative economic importance, size, and structure as compared with the U.S. coal industry. Appendix C provides more details on the coal industry of Poland.

The Polish coal industry is in a period of radical transition from Central Government control of the mines to independent mines. Twenty-three mines were removed from the supervision of the Common Organization of Hard Coal (COHC, or Wspolnota Wegla Kamiennego) and gained independence starting January 1, 1990. The remaining mines, services, and supply companies were removed from the COHC on April 24, 1990. The State Hard Coal Agency, the successor agency to the COHC, was established in July 1990, and is now responsible for promoting and introducing technical advancement, liquidating the economically infeasible mines, and disbursing the operating subsidies.

Industry in Perspective

Poland has a long and colorful history of coal mining. The first recorded coal mining in Poland took place in the 1300's in Lower Silesia. Upper Silesia has figured prominently in both history and production for the last 200 years.

Poland accounts for about 5 percent of world coal production while the United States produces about 18 percent.[1] In 1990, Polish salable hard coal production was 147.6 million metric tons (Mmt), almost all of which (146.2 Mmt) was produced in the Silesian basins. A single mine under construction in the Lublin basin contributed the remaining 1.5 Mmt of hard coal production. U.S. salable coal production in 1990 was approximately 934 Mmt. All of the hard coal in Poland is mined using underground longwalls, while in the United States only 41 percent of total production is mined by all underground methods.

Polish coal production from the Silesian basins in 1990 produced revenues at the mine mouth of 20.1 trillion zlotys (Zl), or approximately US $2.1 billion at an average 1990 exchange rate of Zl 9,500/US $1.00. Total costs, however, were 26.9 trillion Zl, or $2.8 billion. This amounts to a net loss of approximately $4.91/mt of salable coal prior to subsidies. Employment in the

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[1] Annual Prospects for World Coal Trade 1989, Energy Information Administration, U.S. Department of Energy, May 1990.

Silesian mines was 387,903 total, with 262,503 of those listed as underground workers.[2] U.S. production in 1990 was valued at approximately $22.4 billion at the mine mouth and employed 131,306 workers.[3]

Poland exports approximately 19 percent of its salable coal production and the United states exports 10 percent of its salable production. Poland is the sixth ranked coal exporting country in the world while the United States is the second. Poland supplies about 8 percent of the coal sold in world trade while the United States supplies about 24 percent.[4]

About 12 percent of Polish production is consumed by coke plants, 34 percent by the electric power industry, and 8 percent by the communal and residential sector. Industrial use (including self-consumption by the mines, many of which operate their own district heating and powerplants) accounted for the remaining consumption.

The importance of the coal industry to Poland's energy supply cannot be overemphasized. Coal is the only major indigenous energy resource, accounting for approximately 95 percent of primary energy production, and about 77 percent of total energy consumption. Approximately 99 percent of Poland's electricity in 1989 was generated by coal (almost 60 percent from hard coal and 39 percent from brown coal).[5] Coalbed methane, while virtually undeveloped, is another significant potential energy resource for Poland.

All the hard coal mines in Poland are currently owned by the state, although the Polish Government is planning to privatize the mines. Current plans are to create 10 to 15 independent, commercial companies from the existing hard coal mines. Once the situation stabilizes (after closure of uneconomic mines and full decontrol of pricing, now scheduled for the end of 1992), the Government plans to either sell shares in the companies or

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[2]Zestawienie Wskaznikow Techniczno-Ekonomicznych Kolpaln, Za Rok 1990, Centralny Osrodek Informatyki Gornictwa.

[3]Quarterly Coal Report, October-December 1991, Energy Information Administration, U.S. Department of Energy.

[4]Annual Prospects for World Coal Trade 1991, Energy Information Administration, U.S. Department of Energy, June 1991.

[5]Polish Coal, General Information, The State Hard Coal Agency, Joint Company in Katowice, August 1990.

encourage joint ventures with foreign investors.[6] The companies would lease mining concessions and own and operate the facilities, with the state retaining ownership of the reserves. This leasing plan is similar to the situation which prevails in the Western United States. Unlike the Eastern United States, where most coal deposits are privately owned, most western U.S. coal is owned by the Federal Government and leased to private companies, who must bid and pay bonuses, lease payments, and production royalties.

The Council of Ministers of the Government of President Mazowiecki doubled domestic coal prices in October 1989 (to about US $12.85). On July 1, 1990, it decontrolled the administered prices for coal and coke, and raised the official prices of electricity by 80 percent and natural gas by 100 percent.

The Council required coal and coke producers to notify the Finance Ministry in advance of any planned price markups. Specifically, the mines must notify the local tax office of planned price increases. The tax office can postpone the increase for 3 months and thereafter deny excessively high increases. The Council also sets the monthly wage indexation coefficient for adjusting the miners' pay.

By July 16, 1990, 65 of the 70 producing mines served notice they intended to raise prices by an average of 100 percent. The were told by the Katowice tax office, which has administrative control over prices the Silesian mines can charge on domestic coal, that a 15 percent rise was all that would be allowed. The tax office has been limiting hard coal price increases to 5 percent per month since that time.

Export prices are set by international markets. The importance of the export market is substantial because domestic prices have been regulated by the Central Government in the past while the export prices were substantially higher.

The f.o.b. value of Polish coal exports in 1990 was approximately Zl 9,192 billion ($968 million), which represents about 6 percent of the country's total merchandise exports. U.S. coal exports were valued at $4.6 billion in 1990, and over the last 10 years represented from 1 to 3 percent of total U.S. merchandise exports.

Polish coal exports prior to January 1990 were controlled through the state owned and operated export firm of Weglokoks. After January 1990, the mines were free to negotiate their own

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[6]Poland - Heat Supply Restructuring and Conservation Project, Letter of Sector Development Policy, From the Minister of Industry to the World Bank, 1991.

export contracts, although 65 of the 70 mines in Silesia signed export contracts with Weglokoks, ostensibly to maintain continuity in the export market. In 1990, exports totalled 28 Mmt, down slightly from 1989's total of 28.9 Mmt. Most of the exports (62 percent) went to western countries. Polish coal exports peaked in the mid 1980's, reaching 43 Mmt in 1984. About 66 percent of Poland's coal exports are steam coal. In contrast, only 40 percent of U.S. coal exports are steam coal.

Poland is the fourth largest hard coal producer in the world, ranking after China, the United States, and the Commonwealth of Independent States (CIS). Ten percent, or 36 billion metric tons, of the world's coal reserves are located in Poland (ranking it fourth after China, the CIS, and the United States).

The Polish coal industry is regulated primarily by the Central Government, while the U.S. coal industry is extensively regulated by both Federal and State Governments. In some instances the local Government of Poland exerts control over the mines such as mining beneath a town, in which case the mines must coordinate the mining plans with the local Government. Also, the local tax districts in Poland can disallow price increases if deemed excessive, at least through the end of 1992. All of the coal resources in Poland are owned by the state. In the Eastern United States, most coal deposits are privately owned, while most western U.S. coal is owned by the Federal Government. While basic labor, health, safety, and environmental controls and standards are mandated by the Polish Central Government, many of the penalties assessed on Polish operations, particularly the subsidence penalties, are levied by local committees. The mines usually reach a negotiated settlement for damage levies assessed by the local committees.

The injury rates in Poland's coal mining industry are not directly comparable with those of the United States because of differences in the definitions of lost time accidents. However, fatality rates can be compared as they are computed on a common basis. The fatalities in Polish coal mines in 1989 and 1990 were 81 and 107, respectively, compared with 68 and 66, respectively, for the U.S. coal mines.[7,8] The fatality rate (per 1,000 mine workers per year) was approximately 0.195 and 0.216, for coal and all mining and quarrying operations, respectively, in Poland in

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[7]Telefax from Instytut Wolnych Zwiazkow Zawodowych, Warsaw, Poland, September 8, 1992.

[8]U.S. Department of Labor, Mine Safety and Health Administration.

1989.[9] This compares with a rate of 0.350 and 0.086 in the United States for coal and all mining and quarrying operations, respectively. While the total number of Polish fatalities is higher, the rate for coal mine fatalities is lower, simply because of the much higher number of coal miners in Poland.

The Polish coal industry is highly mechanized, with 89 percent of total production coming from longwall panels. Labor productivity, as in the United States, varies substantially depending on the geology of the coal seams, mining methods and other factors. Generally, labor productivity in Polish coal mines is substantially lower than that in U.S. coal mines. In 1990, the Polish industry's average productivity per miner per year was 377 mt salable coal, while the U.S. coal industry's average was 7,110 mt.

Wages for Polish miners vary by mine and position. The average monthly wage for all workers in coal mines, metal mines and quarries in 1989 was Zl 383,613 ($267).[10] Table 2.1 shows the average monthly wage for mine and quarry workers for the years 1980 through 1989. Discussions with mine managers in Poland revealed that by September 1990, monthly wages had risen to a level of approximately Zl 2,000,000 ($210) for the average underground coal miner, Zl 2,600,000 ($274) for underground supervisors, and Zl 1,150,000 ($121) for administrative and clerical personnel. While this may appear to be a substantial wage increase in terms of zlotys, when adjusted for inflation and current exchange rates, the earning power of the miners appears to be deteriorating. Salaries for all of the miners are supplemented by payments in kind of food (it is local tradition to provide a meal to the miner after the shift), subsidized housing and utilities, and state medical care.

Mine workers also receive other benefits such as training, education, subsidized vacation packages, cultural amenities, and recreational facilities. Most of the mines own and operate their own beach and mountain vacation hotels, primarily for the benefit of their workers. These operations typically operate at a net loss, even though they do book customers other than mine employees. Mines may also operate their own gymnasiums, and hospitals or health clinics. Some of the mines sponsor employee participation in folk dancing and musical groups, providing funds for travel, instruments, and costumes.

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[9]The fatality rate for coal mines was calculated, the rate for all mining and quarrying operations is from the Year Book of Labour Statistics, 1991, 50th issue, International Labour Office, Geneva, Switzerland.

[10]Year Book of Labour Statistics, 1991, International Labour Office, 50th Issue, Geneva, Switzerland.

TABLE 2.1
Mining and Quarry Wage Rates

	1983	1984	1985	1986	1987	1988	1989
Polish Zlotys	28,547	33,153	40,484	49,129	58,342	102,744	383,613
Exchange Rate Zl/$	92	113	147	175	265	431	1439
U.S. Dollars	310	293	275	281	220	238	267

Source: Year Book of Labour Statistics, 1991, 50th Issue, International Labour Office, Geneva, Switzerland.

Table 2.2 shows the exchange rates and other key Polish economic data for 1985 through 1991. The Polish zloty underwent a huge devaluation in 1990 when the Government freed up exchange rates, and essentially tied them to a basket of European currencies. This devaluation increased the competitiveness of the Polish coal industry relative to the United States, to the extent that it was not offset by inflation. As shown by the table, however, Poland has experienced a significant increase in the consumer price index. This increase translates to an inflation rate of 351 percent in 1989, and 686 percent in 1990.

Depreciation or devaluation of a currency does not necessarily benefit an individual mine or industry if its capital structure is not denominated entirely in its native currency. If its debt capital was borrowed from other countries, or denominated in foreign currency, then exchange rate movements can either improve or worsen its international competitiveness, depending on the currencies involved and the exact capital structure. Typically, however, at least the operating and tax costs are denominated in the native currencies. When the owners of the industry are in fact the Central Government, as is the case with Poland, and much of their external debt is denominated in foreign currencies such as the dollar, there exists an absolute need to continue exports to generate needed foreign exchange to repay the debts. Coal is one commodity which is, at least for some applications, relatively fungible, and for which there is a large, established international market. For these reasons, it is expected that Polish exports will continue for some years to come, despite whatever problems that may exist.

TABLE 2.2
Key Polish Economic Indicators
1985 - 1991

	1985	1986	1987	1988	1989	1990	1991
Exchange Rate (Zl/US$)	147	175	265	431	1,439	9,500	10,576
Consumer Price Index (1985=100)	100.0	117.7	147.4	236.1	828.9	5,684.3	9,680.2
Producer Prices: Industry (1985=100)	100.0	117.8	149.2	238.4	745.6	5,385.8	7,976.5
Wages: Average Earnings (1985=100)	100.0	121.1	147.0	270.4	1,035.7	4,817.1	7,696.9
Industrial Production (1985=100)	100.0	104.2	107.5	112.7	111.1	82.1	69.8
Exports (Billion zlotys)	1,691	2,116	3,237	6,012	19,476	129,455	157,716
Volume of Exports (1985=100)	100.0	104.9	109.9	120.0	120.2	130.1	133.5
Merchandise Exports, f.o.b. (Million U.S. dollars)	10,945	11,926	12,026	13,846	12,869	15,837	N/A
Gross Domestic Product (Billion zlotys)	10,367	12,953	16,940	29,629	118,319	606,726	N/A
Gross Domestic Product* (Billion U.S. dollars)	70.5	74.0	63.9	68.7	82.2	63.9	N/A

* Calculated.

Source: International Financial Statistics, 1992, International Monetary Fund.

Reserves and Production

Poland's total geological resource of hard coal (anthracite, bituminous and subbituminous) is 65.2 billion mt. An estimated 29.6 billion mt is located in developed fields, and 12.4 billion mt of this (approximately 45%) can be extracted under current technological and economic conditions.[11] Poland ranks seventh with approximately 2.5 percent of the world's total recoverable coal reserves.[12]

Approximately 75 percent of total production is hard coal, although lignite production is rapidly increasing in importance, with lignite production doubling since 1980. A third of the new lignite production increase is from a single new surface mine,

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[11] Polish Coal, General Outlook, State Coal Agency, PLC, Katowice, October 1991.

[12] International Energy Annual, 1990, Energy Information Administration, U.S. Department of Energy.

Belchatow, in central Poland. At full capacity, this mine will produce 40 Mmt annually, roughly 50 percent of Poland's total lignite production. About 90 percent of Belchatow's output is burned at a mine-mouth power station. This 4,300 megawatt facility is the largest coal-fired powerplant in Europe. For the remainder of this report, the focus will be on hard (bituminous and subbituminous) coal production. Table 2.3 presents statistics on Polish hard coal production and exports.

TABLE 2.3
Polish Hard Coal Production and Exports
million metric tons

	1950	1960	1970	1980	1985	1988	1989	1990	Mid-1991
Salable Production	78.0	104.4	140.1	193.1	191.6	193.0	177.6	147.6	70.7
Exports	26.6	17.5	28.8	31.0	36.2	32.2	28.9	28.0	8.9

Sources: Polish Coal, General Outlook, State Coal Agency, PLC, Katowice, October, 1991, and Coal Information 1990, International Energy Agency, Paris, France, 1990.

The three major coal basins are Upper Silesia, Lower Silesia, and Lublin. All of the coal reserves and mines in Poland are currently owned by the state, although the Polish Government is planning to privatize the coal mines through sales of stock or joint venture investments with foreign companies. A concession, or leasing, arrangement is being developed for the orderly exploitation of the state-owned coal reserves in Poland.[13]

Natural hazards and difficult mining conditions are prevalent in all of the Polish hard coal mines to a greater or lesser extent, simply because of the nature of coal-bearing strata and the depth of cover. Mining multiple seams within the same mine is practiced throughout the Polish industry. Coal dust hazards are inherent to all coal mines. Methane concentrations are unusually hazardous at 29 mines, with a tendency toward methane outburst of the coal, roof and floor strata in 3 mines, and outbursts of rock and carbon dioxide in another 4 mines. Simple bumps, or rock outbursts, are prevalent in 36 of the 70 operating mines. 40 mines operate in seams prone to spontaneous combustion, and 54 mines are subject to serious water inflows. Virtually all of the deeper workings are subject to relatively high rock temperatures often ranging from 36°C to 40°C. Tough mining conditions because of excessively hard coal can be found at 40 mines and most of the mines must cope with thin coal seam thickness at one or more operating levels.

[13]Work cited in footnote 6.

The most important of the coalfields is Upper Silesia, which has the largest perspective reserves (28.3 billion mt), extractable reserves (11.9 billion mt), and the most operating coal mines (65). See Appendix C for a detailed description of Polish reserve classifications. The total area of the coalfield is approximately 4,500 km^2. Of this total, 1,850 km^2 are developed by active mines, 1,250 km^2 are potentially minable, and 1,400 km^2 have insufficient reserves or the coal is too deep to be considered for development. The entire coalfield is characterized by multiple seams (200 significant coal seams have been identified) at considerable depth. The significant seams range from 0.7 to 5.0 m in thickness, with some seams reaching thicknesses of 20 m in localized areas. The average depth of mining is approximately 560 meters and is increasing yearly as the more shallow seams are depleted; the deepest workings are at approximately 1,300 m. Table 2.4 presents statistics on the extractable and perspective coal resources for the three hard coal basins in Poland. Figure 2.1 illustrates the locations of the various coal basins as well as the main rail lines to export facilities on the Baltic Sea.

The Lower Silesian coalfields have extremely difficult geological conditions and little in the way of reserves: 0.2 billion mt of extractable hard coal reserves have been identified and no meaningful perspective geological reserves have been identified. There are four operating mines in the Lower Silesian coalfield, three of which are scheduled for closure (Thorez, Victoria, and Walbrzych) because of high mining costs.[14]

The Lublin Basin, which is located in eastern Poland, is a recently discovered (1950's) coalfield with only one mine under construction. The field contains perspective reserves of 7.3 billion mt and extractable reserves of 0.3 billion mt. The proven deposits cover an area of 754 km^2 and the total area of the perspective deposits covers 9,100 km^2.

Production methods in Polish hard coal mines differ substantially from U.S. practice, although both methods are termed longwall mining. The Polish mines use a single entry longwall system common throughout Europe. Steel arches set every meter along the length of the development entry support the roof of the heading, which has a cross sectional area from 12 to 16.5 m^2. The typical Polish longwall section will also operate two longwall panels side-by-side, ventilated off of a single intake split. U.S. mines almost always use multiple entry developments to maintain bleeder entries into the gob, and to provide additional avenues for ventilation and escape. Each operating longwall panel in U.S. mines must have its own ventilation circuit.

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[14]Work cited in footnote 11.

TABLE 2.4
Hard Coal Resources in Poland*
billion metric tons

Perspective Geological Reserves

Coalfield	Steam Coal	Coking Coal	Other	Total
Upper Silesia	21.0	6.5	0.8	28.3
Lublin Basin	6.1	1.2	0.0	7.3
Total	27.1	7.7	0.8	35.6

Reserves Meant for Extraction

Coalfield	Steam Coal	Coking Coal	Anthracite	Total
Upper Silesia	6.9	5.0	-	11.9
Lublin	0.3	-	-	0.3
Lower Silesia	-	0.1	0.1	0.2
Total in Developed Deposits	7.2	5.1	0.1	12.4

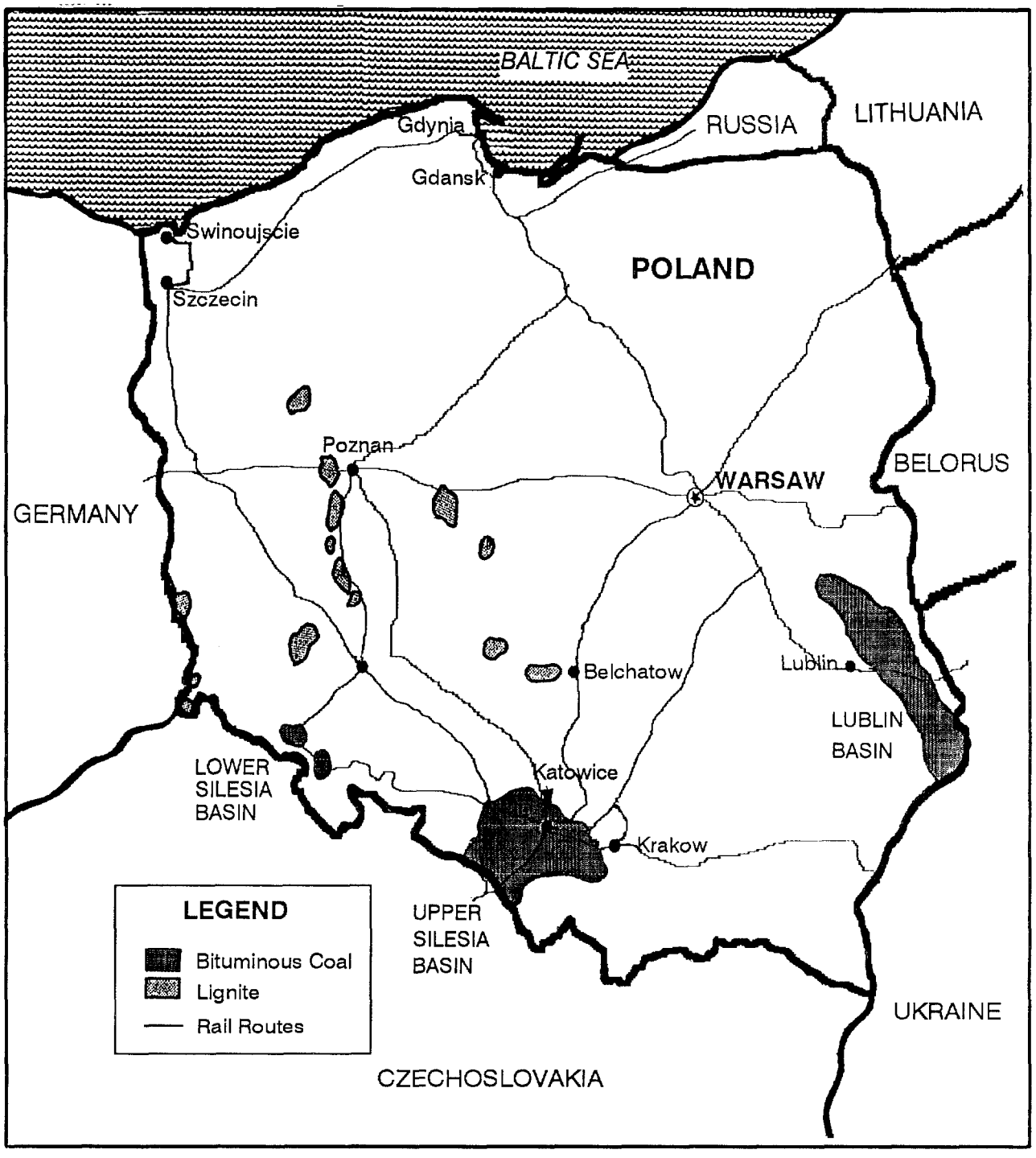
Reserves Meant for Extraction by Seam Thickness

	Total		Standing in Pillars	
Seam Thickness (meters)	Reserves	Percent	Reserves	Percent
Up to 1.0 m	1.2	10	0.1	4
1.01 - 1.5 m	3.6	30	0.5	20
1.51 - 3.0 m	4.4	35	0.9	36
3.01 - 4.0 m	1.3	10	0.3	12
Above 4.0 m	1.9	15	0.7	28
Total	12.4	100	2.5	100

* U.S. and Polish resource classifications differ significantly. For the purposes of reporting coal resources here, we will use the tonnages and nomenclature as reported by the Polish authorities. Specifically, "reserves" does not have the same meaning of "economically recoverable resource" as in the U.S. classification system. See Appendix C for a more detailed description of the Polish reserve classification.

Source: Polish Coal, General Outlook, State Coal Agency, PLC, Katowice, October 1991.

Figure 2.1
Polish Coal Resources
and Major Rail Routes



Polish longwall panels are also typically shorter and narrower (average of 150 m wide, 762 m long) than U.S. longwall panels (average of 200 m wide, 1,160 m long). This appears to be due to the limitations of the domestically produced equipment more than any other reason. For example, domestically produced armored face conveyor chains were said to lack strength and durability; they would fail prematurely if much longer than about 150 m and they still had to be replaced every 1,000 m of advance, even at the shorter face widths. Mine personnel stated they were planning on importing equipment for the express reason of developing longer and wider panels to achieve greater productivity.

Another significant difference is that main development entries in Polish mines are driven in rock, with the longwall development entries, or submains, angled up or down slightly to reach the coal seam. In U.S. mines, virtually all of the development entries, both mains and submains, are driven in the coal seam. The Poles use Alpine Miners, or roadheaders, to drive the development entries. U.S. mines typically use continuous miners for development. Polish laws mandate 100 percent recovery of coal seams, and this development method maximizes resource recovery. But it does so at the expense of development speed, and productivity. The relatively slow advance of the Polish development entries, coupled with the lack of salable coal production and the large amount of waste rock generated, increases costs substantially.

Coalbed methane resources in Poland are large and virtually untapped. This is due to the depth of the coal and the occurrence of multiple coal seams over most of the two primary basins, Lower and Upper Silesia. Although mining activities are estimated to emit approximately 4 billion cubic meters (m^3) of methane per year, the total resource is estimated to be 1,299 billion m^3, of which approximately 721 billion m^3 is considered to be documented reserves in concession areas in the Lower and Upper Silesia coal basins. The documented reserves are approximately equivalent to 900 Mmt tons of hard coal on a contained energy basis. Development of these reserves could add significant alternative energy sources to Poland's current energy balance. Table 2.5 shows the estimated methane resource by coal basin and classification.

The Polish Government has delineated concession areas in Lower and Upper Silesia for potential production of coalbed methane. In July 1990, a new law consolidated and codified the legal basis for concessions in the mining and methane extraction areas. Unfortunately, ambiguities over previously negotiated concession contracts caused confusion over the validity of some contracts. While this is expected to delay production in some areas, the

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confusion over the legality of older concessions appears to be temporary.

TABLE 2.5
Estimated Coalbed Methane Resources in Poland
billion cubic meters

Upper Silesian Coal Basin	
Total reserves in concession areas	710
Undiscovered resources*	570
Total estimated resources	1,280
Lower Silesian Coal Basin	
Total reserves in concession areas	11
Undiscovered resources**	8
Total estimated resources	19
Grand Total Upper and Lower Silesia Basin	1,299

* (Avg. gas content=12.3 m^3)
** (Avg. gas content=24.2 m^3)

Source: Opportunities for the Development and Utilization of CBM in Poland, a presentation by Raven Ridge Resources, Grand Junction Colorado, to the Global Change Division, U.S. Environmental Protection Agency, Washington, DC, January 15, 1990.

Industry Structure and Labor Management Relations

The Polish coal industry's organizational structure is undergoing tremendous change. While the names of the organizations changed, the mines continued to operate as part of the command-distribution structure until 1990. Under the Hard Coal Federation, virtually all of the mines were grouped into four operating units, or Coal Extraction Enterprises. Other bureaucratic organizations of interest included the Central Coal Bureau and Weglokoks, the domestic and export sales companies, respectively. All sales, including sales to Weglokoks, which had the export monopoly for Polish coal, were funneled through the Central Coal Bureau until 1989.

The last major organizational change was in 1990, when the mines were granted more autonomy and the bureaucratic structure was altered again. The State Coal Agency is now the Government-owned overseer of the 71 individual mines, which are functioning as independent units. The State Coal Agency was established July 12, 1990 to represent the State Treasury as a joint stock

company. The State Coal Agency is responsible for preparing forecasts for hard coal demand, publishing the hard coal balances; assessing the market situation, conducting the restructuring, organizing investment ventures and geological exploration, examining production capability, assessing the mines' economics, promoting and implementing technological advancement, closing unprofitable mines, and improving mining health, safety, and environmental practices.[15]

The State Coal Agency is now in the process of closing some mines and consolidating the others into logical operating units for privatization. The idea, as originally suggested by the World Bank and adopted by Poland, is to create 10 to 12 operating units, each consisting of 4 to 6 mines. However, recent press reports state that 7 groups will be operating 64 remaining mines.[16] Current plans are to close three mines in Lower Silesia: Thorez, Victoria, and Walbrzych. Other mines are also under consideration for closure.

Political life in Poland is influenced heavily by organized labor. Organized labor, principally through the union Solidarity, brought about the removal of the former Communist Government and continues to influence politics in Poland. Union representatives have held the presidency (i.e., Lech Walesa) and union mine representatives often hold seats in the Polish Parliament. To a lesser or greater degree, all of the Polish coal miners' unions have struck for practical or political reasons, and they appear willing to do so again to make their voice heard as decisions on mine closures and privatization are made.

Line management and labor usually work very closely with each other in Poland. Organized labor is a simple fact of life for the Polish coal industry, as mine managers are essentially voted in by the workers. Prospective mine managers must pass exams written by a committee from the Ministry of Industry, and must undergo psychological evaluations and receive recommendations of the Polish Academy of Science. The exams contain a broad range of material on engineering, law, and business responsibility and practice. All candidates must prepare written statements of their vision of the future for the coal mine and present them orally before the committee, which may question the candidates on details of the plans, the law, and business responsibility and acumen. A scoring system is used to rank the candidates tests, plans and presentations. After the points are tallied, the top two candidates are presented to a workers' council (there is one

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[15]Work cited in footnote 11.

[16]Poland Seen Restructuring to Seven Groups by Jan. 1, 1993, Coal Week International, October 27, 1992.

for each mine) for similar questioning, after which the council must choose one of the candidates for the position.

There are three major coal labor unions in Poland: Ogolnopolskie Porozumienie Zwiackow Zawodowych (OPZZ, or All Poland Alliance of Trade Unions), Niezależny Samorzadny Zwiazek Zawodowy (NSZZ, or Solidarity), and the administrative workers' union. Approximately 30 percent of all coal miners have no union affiliation. Of the coal mining unions, OPZZ is the largest, with a significant overall membership advantage over the next largest union, NSZZ Solidarity, in representation of coal mine workers. The OPZZ union represents approximately 40 percent of the coal miners. The OPZZ union was formed in 1981 or 1982 under the auspices of Communist rule, which helped earn it the nickname among the miners of "the Communist union." It is one of the more vocal opponents of the Government's plans to shut down mines and reduce the number of Polish coal miners.

NSZZ, or Solidarity, the trade union made famous by its role in toppling the former Communist Government through its nationwide strikes, is the second largest union representing the coal miners. At some mines it is the dominant union. It represents approximately 26 percent of the coal miners. This number includes representation among the miners by a splinter group of Solidarity known as Solidarity 80.

Another union of importance to the mines is the administrative workers' union. This is the smallest of the three major unions and represents an estimated 2 percent of all workers, principally technicians, draftsmen, accountants, and other clerical workers.

Domestic Coal Use

Coal is the single largest energy source in Poland. Coal accounted for 96 percent of Poland's primary energy production and 81 percent of primary energy consumption in 1990.[17] With limited domestic reserves and production of oil and gas, low hard currency reserves for imports, and distrust of nuclear generated power by the general populace, coal will continue to be the primary energy source in Poland for the foreseeable future. Conservation and nonconventional energy sources such as coalbed methane are rapidly gaining in importance, but their contribution will be minor for some time to come.

The primary use of coal is for the generation of electricity. Virtually all electric powerplants in Poland are coal-fired, whether from lignite or hard coal. Fossil fuel plants (lignite or hard coal) accounted for 99 percent of all electricity

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[17]Work cited in footnote 16.

generated in 1989.[18] Virtually all the lignite is burned in mine-power stations, district heating plants, or used for space heating. Of the 120 Mmt of hard coal consumed domestically in 1990, 50 Mmt went to the power sector, 18 Mmt to coke plants, 13 Mmt to the communal and residential sector, and the remaining 39 Mmt went to industrial plants, district heating plants, and combined heat and power plants operated by the coal mines.

The former system of central planning emphasized heavy, energy intensive industries most of which were supported both directly through capital investments and operating deficit grants, and also indirectly through the extensive subsidies to the Polish coal industry. Little or no efforts were made to conserve energy, either in industry or among the general population, because of the abundance and artificially low price of hard coal. Four decades of these policies in Poland have left a legacy of severe air, water, and soil pollution, with concomitant deterioration in public health. As a result, average life expectancy is lower now than it was 20 years ago.

While the bulk of the bituminous coal mined is relatively low sulfur (less than 1 percent sulfur), a complete lack of combustion controls and grossly inefficient operating practices by industry and residential users alike virtually ensures that major coal producing and consuming regions are continually engulfed in airborne particulates and byproducts of incomplete combustion. The World Commission on Environment and Development has reported that in Katowice (a major mining and industrial center in the heart of Upper Silesia), safety limits are often exceeded for levels of sulfur dioxide by 2 times, lead by 196 times, airborne dust by 35 times, nitrogen oxide by 6 times, and carbon monoxide by 21 times.

Poland's coal consumption appears to be becoming more directly tied to its overall level of economic activity. Declines in the Polish Gross Domestic Product (GDP) in 1990 are reflected in a substantial drop (in excess of 30 Mmt) in the consumption of coal. Much of the drop in coal consumption for 1990 is tied to the Government's decisions in late 1989 and early 1990 to reduce energy subsidies and allow coal prices to rise.[19] The drop in production in 1989 is generally attributed not to recession (GDP rose in 1989), but as a result of coal labor succeeding in

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[18]Polish Coal, General Information, The State Hard Coal Agency, Joint Company in Katowice, August 1990.

[19]Transition from a Centrally Planned Economy to a Market Economy: The Case of Poland, Adam Budnikowski, Technological Forecasting and Social Change 41, 1992.

gaining voluntary Saturday work shifts.[20] Similar drops in GDP in 1985 and 1987 caused virtually no change in coal production (less than 10 Mmt). From 1982 to 1988, coal production was remarkably stable. In 1990, however, coal consumption fell dramatically with the drop in GDP.

Exports

Coal exports are extremely important to the Polish economy, accounting for 19 percent of coal production and generating export revenues of approximately US $968 million in 1990. Exact revenues are difficult to pin down because some coal was traded through barter arrangements for crude oil or consumer goods. Approximately one-fourth of the coal exports is coking coal and the remainder is steam coal. Approximately one-half of all exports are to Western countries and one-half are to former Eastern bloc countries. Table 2.6 gives coal export shipments by country for the years 1988 through 1990.

Exports prior to 1990 were the exclusive responsibility of Weglokoks, the state coal exporting company. Even after the mines were relieved of their obligation to sell through Weglokoks, most of the key export mines signed contracts with Weglokoks. Ther contracts were signed first for short term 1 and 2 year periods, but more recently were signed through 2000 to 2002, making Weglokoks the mines' exclusive sales agent for export coal.[21] Prior to 1991, there was also a requirement that mines could not sell their coal on the export market for less than the price negotiated by Weglokoks.

The geographical location of the export mines relative to the import markets is an important cost variable in determining the competitiveness of U.S. and Polish coals in the major world markets. Poland's location enables it to serve European markets, particularly interior markets, very well. The Appalachian coalfields, which account for around 95 percent of all U.S. coal exported, are favorably located to serve the European markets, but transfers between transportation modes (i.e., oceangoing vessel to rail) can add significant handling charges to delivered costs in some markets in Central and Eastern Europe. For these markets, U.S. coal exporters are usually at a geographical disadvantage compared to Polish coal exporters.

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[20]"Polish Exports of Fossil Fuels in 1989 in the Light of the International Coal Market Position," Polish Coal Review, Volume 45, No. 1, Weglokoks, Katowice, Poland, 1990.

[21]"Weglokoks Gathers in the Flock," Financial Times International Coal Report, Issue No. 306, September 7, 1992.

TABLE 2.6
Polish Hard Coal Exports by Country
(thousand metric tons)

Eastern Europe	**1988**	**1989**	**1990**
Albania	63	94	12
Czechoslovakia	1,677	1,398	1,628
Hungary	668	568	209
Romania	1,312	1,363	129
U.S.S.R. (CIS)	11,726	9,950	8,580
Yugoslavia	171	215	134
Total	15,618	13,589	10,692
European Community			
Belgium	518	293	355
Denmark	1,658	835	977
France	247	406	386
Spain	259	150	198
Netherlands	790	790	1,216
Ireland	722	581	470
Portugal	70	32	40
Germany	2,630	2,410	3,474
Italy	846	789	736
United Kingdom	1,278	1,270	945
Total	9,017	7,556	8,797
Other Europe			
Austria	1,846	1,719	1,886
Finland	2,038	2,599	2,778
Norway	125	26	87
Sweden	976	759	735
Switzerland	123	173	287
Total	5,108	5,275	5,772
Other Non-European			
Algeria	153	148	0
Argentina	121	152	174
Brazil	1,959	1,646	2,176
India	136	372	284
Iran	59	120	120
Tunisia	3	3	0
Total	2,431	2,440	2,754
Total Eastern Europe	16,556	15,271	17,323
Total All Countries	32,174	28,860	28,014

Sources: Polish Exports of Fossil Fuels in 1989 in the Light of the International Coal Market Position, Polish Coal Review, Weglokoks, Katowice, 1990; Coal Year 1991, International Coal Report, Financial Times Business Information Ltd., 1991.

Coal Transportation and Ports

The primary transportation mode for coal shipments is by rail. Because of its location, virtually all coal for export or for shipment out of the immediate area of Silesia must move by rail. Small amounts of coal are moved by truck or horse-drawn wagons to local industrial and residential customers.

The Polish State Railway, or Polskie Kolwje Panstwowe (PKP), is under the direction of the Ministry of Transport and operates all of the country's rail lines. Published tariffs, set by the Ministry and approved by the Government, are calculated by commodity class and distance; there is no negotiation over price. Freight tariffs reportedly cover costs by a significant margin and effectively cross-subsidize other traffic.[22] Coal and coke are the largest single commodities moved by the Polish railway system, and together typically account for 40 percent of all commodity traffic by tonnage. Approximately 85 percent of all the coal produced in Poland moves by rail, with most of the remainder consumed at mine-mouth powerplants.

Approximately one-half of all coal exports (14.1 Mmt in 1989) move by rail to customers in Germany, Ukraine, Russia, Czechoslovakia, Austria, and other Eastern European countries. The other half (14.8 Mmt) moves by rail to the coal export facilities at Gdynia, Gdansk BAZ, Port Polnocny (Gdansk North Port), Szczecin, and Swinoujscie, where it is loaded and shipped to overseas customers. Distance by rail varies according to the exact mine and port of exit, but generally ranges from approximately 500 to 650 km. Principal overseas customers include Brazil, Finland, and most of the European Community countries.

The most important port for coal exporting is Port Polnocny (Gdansk North Port). In 1989, this facility moved 6.4 Mmt of coal exports. Its design capacity is 8.5 Mmt, and it is capable of handling 170,000 deadweight ton (dwt) vessels.

Swinoujscie, which translates as the "pig port," is the next largest coal exporting facility, with a stated annual capacity of 5.6 Mmt; it is capable of handling 60,000 dwt vessels. In 1989, this facility shipped 4.4 Mmt of coal exports.

Government Regulations, Taxes and Controls

The Polish coal industry is regulated by the Central Government. The Government owns all the coal reserves; conducts virtually all exploration activities; and regulates health,

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[22] Poland: Reform, Adjustment, and Growth, The World Bank, Washington, D.C., 1987.

safety, environmental practice, transportation, and taxes. Weglokoks has retained a majority of the mines under long-term contract and the Government also levies taxes on coal exports. While the central command structure on the coal industry has been pared back since 1989, some vestiges of the command system remain, principally through domestic price controls.

Although the requirement that all coal sales be conducted through the Central Coal Bureau was lifted in 1990, price increases must still be approved by the local tax districts. The Katowice tax district, which controls the mine-mouth coal prices for the mines in Upper Silesia, has been limiting price increases to approximately 5 percent per month.

Probably the most important piece of enabling legislation for regulation of the Polish coal mines is the Mining Law Amendment of 1978, which superseded the Uniform Text Decree on Mining Law of 1953. Additional amendments, executive orders and regulations to this legislation form the practical basis for the health and safety practices required of the mines, as well as establish the financial responsibility of the mines in cases of damage to surface structures. The Polish Parliament is now considering a major revision to the old mining laws to provide a more comprehensive and less confusing set of legislation and regulations. Many of the existing regulations conflict with each other and the result is that they are often unevenly applied.

Responsibility for the coal mining operations rests in the State Coal Agency, which is part of the Ministry of Industry. The Ministry of Industry is responsible for assessing fines for noncompliance with health and safety regulations pertaining to the mines. Fines for noncompliance are typically grouped under nonmaterial charges in the mining cost system employed by the majority of Polish mines, and can be the largest line item under taxes and penalties for some individual Polish mines.

Polish health and safety regulations on mine ventilation limit methane concentrations in working areas to 2 percent, in contrast to U.S. regulations, which limit methane to 1 percent or less in working areas. The minimum concentration necessary for an explosive ignition of methane and air mixtures occurs at a concentration of 5 percent methane, but fine coal dust suspended in the mixture can lower the ignition point further. While methane and air mixtures alone are not explosive at 2 percent concentrations, the margin of safety for methane buildups under Polish code is obviously lower than that under U.S. code. Polish mines are also allowed to ventilate two longwall panels on a single split, or circuit, of intake air. This practice is prohibited for U.S. mines.

Polish mines use the single entry longwall system common to most European countries. U.S. mines, if they wish to use the

single entry longwall system, must seek an exemption from the regional Mining Safety and Health Administration office responsible for inspecting the mines. U.S. mines typically use a multiple entry system. While an in-depth discussion of the merits and drawbacks of both mining systems are beyond the scope of this paper, the choice of systems has serious implications for the practical ventilation and ground control measures necessary to maintain a safe and healthy working environment. Both systems have advantages and disadvantages.

In some populated areas, the Poles systematically subside entire towns. In these cases, adjacent mines in the area must coordinate, by law and negotiated agreement, longwall advance, often meeting a specific minimum and maximum advance per day or week. Multiple longwall faces are often aligned under such areas, essentially creating a face thousands of meters wide, and subsiding the entire town evenly and on a coordinated schedule. While this method minimizes the damage to surface structures, it creates serious production scheduling problems for the individual mines and contributes significantly to the low productivity at some mines. In isolated cases, the mines actually subside their own shafts, something unheard of at U.S. mines.

Polish mines are liable for damage to surface structures or surface waters by subsidence. Since Polish law requires the mines to seek 100 percent extraction of the significant coal seams, subsidence of the surface is virtually a foregone conclusion unless stowing (placing mine refuse, sand, or power plant fly ash in gob areas) is practiced. While stowing is practiced at many mines, virtually all of the mines incur subsidence damage assessments. Damage assessments are negotiated with a local review committee after a complaint has been filed by an individual. Once an assessment is determined, the committee determines which mine is responsible and levies the assessment on the operation. There appears to be some flexibility in the process, as some mines in the study indicated they had an option of doing the repair work with their own crews, paying the assessment, or some combination thereof.

Polish regulations limit workers at faces with ambient temperatures at or above 28°C to no more than 6 hours per shift, with frequent rest and cooling breaks, such that no more than 4 hours of actual work per shift may be performed. There is no comparable U.S. regulation, because the vast majority of U.S. coal mines are not deep enough to encounter elevated rock temperatures.

The enabling legislation for environmental regulations is an Act of Parliament, January 31, 1980 (No. 3/80). The legislation itself is fairly general. Executive orders and specific regulations enacted since then form the practical basis for the

operating practices of the mines and the fines imposed for noncompliance. The Ministry of Environmental Protection, Natural Resources and Forestry is responsible for levying the fines for noncompliance.

The most visible fine levied for noncompliance with environmental regulations is for discharge of mine waters into surface waters. The fines vary according to both the quantity and salinity of the discharge, and in some cases can be quite substantial. The problem is centered in Upper Silesia, or the Gornoslaski Coal District.

Summaries of Polish and U.S. taxes are presented in Tables 2.7 and 2.8, respectively. The Polish Government levies all the taxes applicable to the coal mining operations. The most significant of these is the 40 percent income tax. Other taxes and charges of interest include the Geological fund, Science and Technology fund, Reclamation fund, Coal Board charge, mandatory subsidence insurance, and charges for licensed technology, patent fees, and technology transfers.

A Target Fund was in place in 1989, but was discontinued in 1990; this fund was used as a merit pay system for Polish workers. Another fund which also was not used in the analysis, the Special Fund, is levied by local municipalities in Poland for damages to local forests caused by acid rain from coal combustion. These particular funds were not of consequence to any of the mines examined in this study (less than 1 cent per ton in 1989) and were therefore not included as line items in the tax and penalty section of the cost analysis.

A significant difference between Polish and U.S. tax laws is that Polish firms can continue to take depreciation on a piece of equipment above the amount of its book value as long as it is in operable condition. This provides an incentive for Polish mine managers to keep equipment in service past its usual life span, and is believed to be a contributing factor to the unusually large inventories of equipment maintained by the mines. Delivery inefficiencies and defective equipment also contributed to this problem. Mines sometimes stockpiled a year's supply of spare parts because that was how long it usually took for replacement deliveries. Depreciation schedules are 4 years for longwall shearers and roadheaders, 5 years for longwall shields, and 10 years for electric and hydraulic components associated with the longwall installations. Longer depreciation periods apply to physical plant such as buildings, shaft development, etc.

TABLE 2.7
Polish Central and Local Taxes
and Other Charges on Mining Activities*

	Polish Central	Katowice District
Income Tax	40%	None
Wage Tax	20% of gross wages	None
Insurance Tax	43% of gross wages	None
Work Fund (Unemployment, etc.)	2% of gross wages	None
Housing Tax	Formula, 0.125% of average wage of all Polish workers, times number of workers at mine, plus 0.08% of weekend wages of all mine workers	None
Geological Fund	Varies, usually charged on tonnage basis; Zl 84.34/mt average for 1989, Zl 189.38/mt December 1989; Exploration services charged differently	None
Science and Technology Fund	Approx. 0.66% of revenue for 1989; 1.2% in 1990	None
Reclamation Fund	Zl 46.80/mt avg. for 1989 Zl 117.08/mt December 1989	None
Coal Board	Determined by state, average 0.1 to 0.2% for 1989	None
Property Insurance	Insurance with state insurance agency mandatory in 1989, moved to contract basis in 1990	None
Subsidence Assessments	None	Set by review committee, and negotiated with complainant
Environmental Protection Assessments	Levied by Minister of Environmental Protection and Natural Resources based on air and water emissions, and published standards	None
Miscellaneous Charges	Varies by mine: consists of licenses, patent fees, charges for technology transfer, etc.	None
Turnover Tax (Export tax)	20% of f.o.b. sales price in 1989, increased to 80% 1/90, decreased to 50% from 4/90 - 8/90, lowered to 20% 8/90	None
Property Taxes	Dividends must be paid if mine is profitable; for use of state assets	Road and local property taxes enacted in 1990
Nonresidents Withholding Tax	Currently 5 or 15%, dependent on amount of foreign holdings, set by bilateral treaty	None

* Taxes, assessments, penalties, and other Government charges as of 1989.

TABLE 2.8
U.S. Federal and State Taxes
and Other Charges on Mining Activities*

	U.S. Federal	Alabama
Income Tax	39% (1987) 34% (1988 and later)	5%
Alternative Minimum Income Tax	20% of alternative minimum taxable income; payable when Federal income tax payable is exceeded	None
Percentage Depletion Allowance	Deduction of 8% (effective rate) of gross income allowed in calculation of alternative minimum income; not to exceed 50% of taxable income from property	None
Royalty	12.5% surface, 8% underground	Varies; 12.5 to 18.75% for State lands, set by bid, or $3.30/mt, whichever is greater; private lands negotiated
Severance Tax/ Business Occupation	None	$0.15/mt excise, $0.22/mt severance
Sales/Use Tax	None	1.5% equipment State Counties: 0.25% Jefferson 2% general Tuscaloosa 1% vehicles Tuscaloosa
Property Taxes	None	65 mills State Counties: 421 mills Jefferson 265 mills Tuscaloosa 250 mills Fayette 235 mills Walker
Coal Fee Rents/ Lease Charges	Bonus bid, nonrecoverable	None
Nonresidents Withholding Tax	30%, exempted for trade or business within U.S.	None
License Fees	None	None
Work Requirements, Fees	Due diligence for Federal leases, no mandatory fees	None
Black Lung Tax	$0.61/mt surface, $1.21/mt underground, or 4.4% f.o.b. mine price, whichever is less lignite exempt	None
Abandoned Mine Lands Fee	$0.39/mt surface, $0.17/mt underground, or 10% f.o.b. mine price, whichever is less, lignite $0.11/mt or 2% of f.o.b. price, whichever is less	None
Reclamation Bonding and Fees	None, State primacy	Minimum $10,000; total set by State, recoverable

TABLE 2.8
U.S. Federal and State Taxes
and Other Charges on Mining Activities-continued

	Virginia	West Virginia
Income Tax	6%	9.675%, decreasing to 9% by July 1, 1992
Royalty	None, no State land currently leased for coal operations	No standard, no active State leases
Severance Tax/ Business Occupation	None	3.85% mine-mouth value +0.88% sales value
Sales/Use Tax	3% on motor vehicles, 3.5% goods and services, None on domestic coal sales	6% excise tax on personal property
Property Taxes**	Counties: 73 mills Lee 59 - 195 mills Buchanan 53 - 219 mills Dickenson 39 - 115 mills Wise	Counties: 274.24 mills Boone 255 mills Marion 239 mills Marshall 247.2 mills Monongalia
Coal Fee Rents/ Lease Charges	None	None
Nonresidents Withholding Tax	None	None
License Fees	None	None
Work Requirements, Fees	None	None
Black Lung Tax	None	None
Abandoned Mine Lands Fee	None	None
Reclamation Bonding and Fees	Minimum bond $10,000, alternative bonding, reclamation tax when fund below minimum	Minimum $10,000; $1000/ acre, alternative bond, reclamation tax when fund below minimum, $0.01/ton

* Taxes and charges as of January 1, 1989.
** County property tax rates may vary according to classification of property.

CHAPTER 3

COMPARISON OF BASIC MINING COSTS

Introduction

This chapter compares the basic mining costs among similar Polish and U.S. coal mines and identifies those factors that account for differences. The basic mining cost is defined as the total cost to extract 1 metric ton of run-of-mine or raw coal delivered to the coal preparation or cleaning plant.

To identify dissimilar cost factors associated with social, political, and economic conditions inherent in national coal industries, cost comparisons must be among mines that have similar stratigraphic and geologic profiles and mining plans, and are reasonably similar in size. It is not necessary that the qualities of the coals be similar, as the objective is to measure raw coal production costs, not the costs of producing 1 ton of salable coal of comparable quality and value. Both the Polish and U.S. mines studied here are longwall mines with reasonably deep cover.

Chapter 4 analyzes the relative market competitiveness between U.S. and Polish coal mines. In a market competitiveness analysis, the mines that are compared must produce salable coal having similar coal qualities. The geology of the coal deposit, type of mine and mining method are irrelevant; only the cost of producing and delivering 1 metric ton of salable coal to the customer is relevant. However, some of the same mines compared in chapter 3 are also used for the market comparison in chapter 4 because they compete in the same markets.

Mine Costing Methodology

The basic mining costs computed for Case I are the average costs to extract 1 metric ton of raw coal over the remainder of the mine's life. These costs are calculated using a continuously discounted cash-flow rate of return (DCFROR) analysis of all capital, mine operating expenses, land, and tax costs.[1] Capital and operating costs are based on engineering estimates of the costs required to operate the mine over its full life. For this analysis, 20 years was chosen as remaining life of the Polish mines. U.S. mines had remaining lives ranging from 20 to 30 years. While 20 years is a normal planning life for many U.S. mines, it is recognized that some Polish mines have operated 100

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[1]The U.S. Bureau of Mines computer program, MINSIM, was used for the DCFROR analysis. MINSIM calculates the average mining cost over the life of the mine (20 years was chosen in this example) for specific rates of return on investments.

years or more. Past approximately 20 years, however, the value of predicted cash-flows becomes exceedingly small if discounted back to the present for calculating either return on investment or net present value of the cash-flows to the project.

Figure 3.1 outlines the basic steps involved in data collection, cost estimating, and engineering and financial analyses. Appendix D (available separately) is a detailed explanation of the methodology. A brief description of the methodology is provided here to outline the key assumptions made and to define essential terms.

The engineering cost estimations and financial analyses of each mine were based on mining conditions and practices in mid 1989 and the average value of the Polish zloty to the U.S. dollar in 1989 (approximately Zl 1,446 = US $1.00).

The capital investment used for DCFROR analysis is the sum of undepreciated capital as of January 1989 plus the additional capital required throughout the remaining life of the mine. Capital investments include coal acquisition, surface rights, exploration, feasibility studies, mine development, mine plant construction and equipment purchases (including required mine health and safety facilities and equipment), mine site infrastructure, replacement of equipment and facilities, and other fees and services normally capitalized. Capital costs for cleaning plants and storage and loading facilities are excluded. In the case of the Polish mines, all of the mines had sufficient reserves to continue operations in excess of 20 years into the future, so closure costs were not included in the analysis. Closure costs also were not included for the U.S. mines in the study.

Mine operating costs are separated in two components: labor, and equipment and supplies. Labor includes wages, employee fringe benefits, and government labor and payroll-related taxes for production, maintenance, and administrative mine personnel. Equipment and supplies includes materials and utilities consumed in mine operation, indirect costs for general items, general sales taxes, and most forms of insurance.[2] One specific form of insurance listed as a separate line item under taxes for the Polish mines is the Government mandated subsidence insurance. Corporate overhead costs are not included in mine operating costs.

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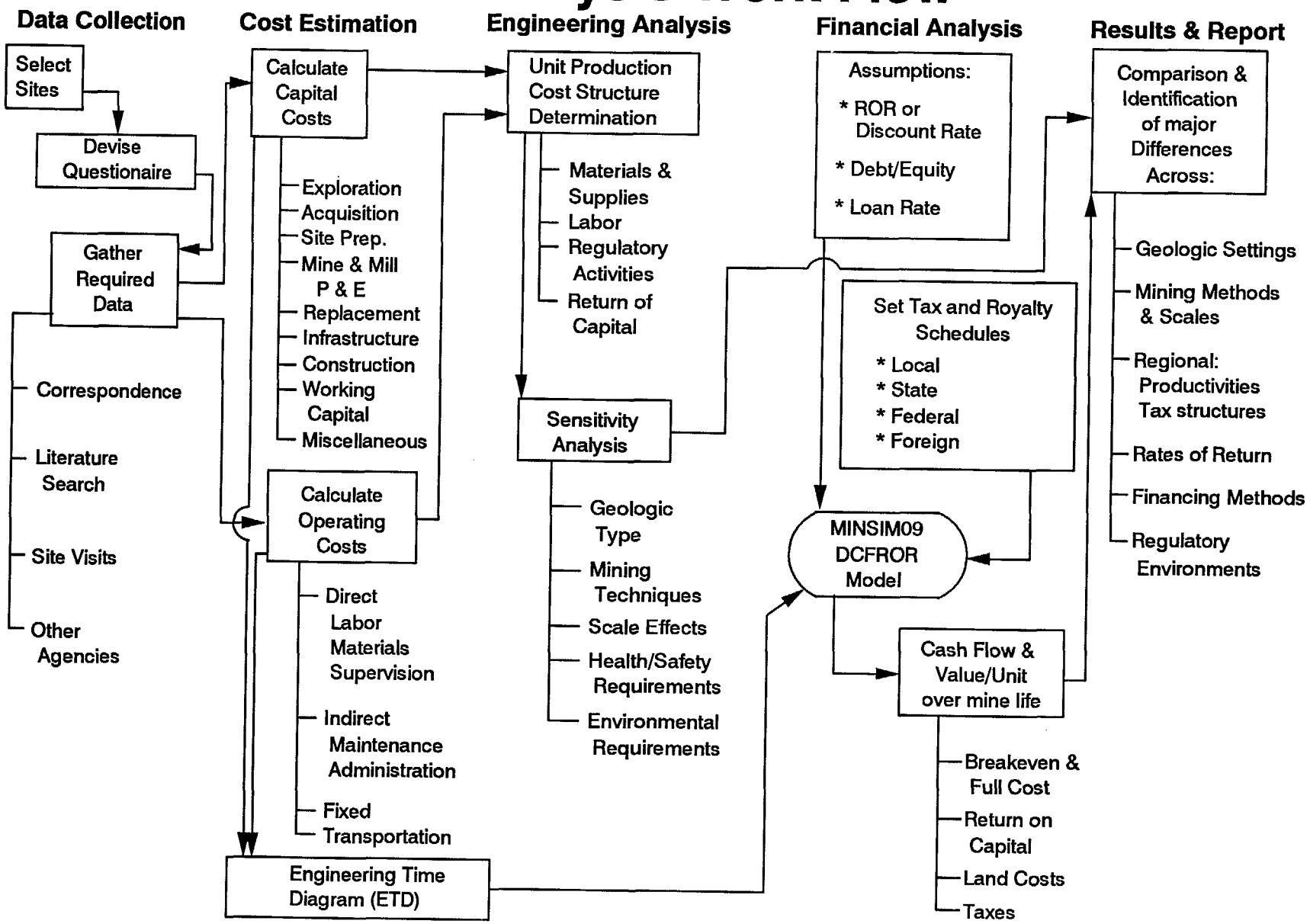
[2]All property administrative personnel were divided between mine and mill in proportion to the number of people in the mine and mill.

Figure 3.1

Coal Analysis Work Flow



To a large extent, costs for complying with mine health, safety, and environmental standards and regulations are inherently integrated into the capital investments and operating cost figures. In this study, certain regulatory compliance costs were isolated, and they are compared in a separate analysis later in the report.

Only mandated requirements were isolated and these covered such items as safety devices, dust control, reclamation, miner training requirements and facilities, and special Government fees, levies, penalties, and taxes. For Polish mines, specific penalties associated with subsidence and environmental, health, and safety assessments by the Polish authorities were included both in the regulatory compliance costs and as individual line items in the analysis, since they were available and played such a large role in the cost structures of individual mines.

Normally, land costs include expenses to acquire the use of surface land, water, and other rights to mine the coal. Representative cost items include private and Government royalties, lease payments, and other miscellaneous fees assessed by the Federal, State and local Governments. While U.S. mines incurred royalty or lease costs up to 5 percent of the value of the salable product, the Polish mines incurred no land costs because they are not yet being charged any rents or royalties by the Polish Central Government, which retains ownership of all the country's coal resources.

Tax regimes used in this study are those in effect in both countries as of 1989, as outlined in chapter 2, tables 2.7 and 2.8.

Taxes are those costs paid by a mining operation to local, state and national government authorities. Polish mines, like the mines in the United States, are subject to Central Government corporate income taxes. Polish mines are also assessed significant subsidence penalties by local review committees. Other forms of taxation at the local level appeared to be minimal, although road and other local taxes were levied in 1990 and 1991. While other penalties, principally environmental, appear in the Polish cost accounting system, Polish mines typically do not pay all of the penalties levied; some apparently are contested. Because the same cost accounting system is used by the Central Government to determine the operating subsidy grants to the mines, all of the penalties listed as costs, including the environmental penalties, are included in this analysis.

Financial Analysis

The financial analyses use average 1989 U.S. dollars and treat each mine as a separate corporate entity. No inflation is assumed over the period of the analysis. Undepreciated capital as of January 1989 (the first year of the analysis) and capital reinvestment for plant and equipment are considered funded with equity capital. Reinvestment capital varies according to mine size, production life, and age of the facilities and equipment. Working capital costs for the Polish mines are as they were reported to Bureau of Mines personnel; for the U.S. mines, they are assumed to be 0.25 times the annual operating cost and are incurred when the mine opens and recaptured at the end of the mine's life.

For the Polish mines, an estimate was made of the cost of replacing the production equipment with domestically produced Polish equipment. In 1989, the Polish mining operations were allowed to lease a major portion of their mining equipment (longwall shearers and Alpine Miner-type roadheaders) at subsidized rates from state-owned manufacturers of the equipment. The remaining mining equipment was purchased outright from state-owned manufacturers. The cash-flows in the DCFROR analysis reflect the 1989 leasing arrangement, but only for 1989. For the remaining period of the analysis (19 years), it was assumed that the Polish operations would be required to purchase all of the mining equipment, including shearers and roadheaders. Based on conversations and correspondence with Polish mine managers and academic researchers, the cost of Polish-produced mining equipment was estimated by Bureau personnel at approximately 43 percent of the cost of comparable western longwall equipment. Polish face equipment is replaced according to the Polish depreciation schedules, which are significantly shorter than U.S. depreciation schedules. Longwall shearers and roadheaders are assumed to have a 4-year life, shields a 5-year life, and other electrical and hydraulic longwall components a 10-year life.

The DCFROR analysis calculates the cash-flow needed for a given return using the financial conditions for the remaining life of the mine. A DCFROR is defined as the rate of return that makes the present worth of after-tax cash-flows from an investment equal to the present worth of all investments. At zero percent return, all mining costs and invested capital are recovered, and there is no return on the investment. At 15 percent discount rate, a net positive cash-flow, equivalent to a 15 percent return on all investments, is achieved. In this study, a 15 percent rate was chosen as representative of a return necessary to compensate for foregone earnings on alternative investments, and for the inherent risks associated with developing or operating coal mines. This 15 percent rate of return is based on continuous discounting and is equal to a 16.2 percent discrete (annual) rate of return.

A DCFROR analysis is a suitable way to compare the costs of mining among different operations. It identifies the effects that direct and indirect operating, regulatory, and other variable business costs have on the cash-flow of an operation, as well as the opportunity cost of capital invested.

To avoid identifying specific mines and the disclosure of company or mine confidential information, the mining costs for individual Polish and U.S. mines are not shown. For the same reason, detailed descriptions of the individual mines are also not presented. The cost ranges shown in the tables represent the lowest and highest costs incurred in each cost category among all the mines in each of the case studies. Therefore, these composite cost values, at either end of the cost range, may not add up to the total basic mining costs derived by adding the component costs for the lowest and highest cost mines. The ranges of costs are used to give a perspective on the variations in cost categories among comparable mines.

Case I: Underground Longwall Coal Mines

Case I compares eight underground longwall Polish mines in Upper Silesia with three deep longwall U.S. mines; one each in Alabama, West Virginia, and Virginia. Table 3.1 summarizes the mine characteristics and operating data for the Polish and U.S. mines used in the study. Figure 3.2 depicts a multiple entry longwall system common to U.S. mines. In contrast, Figure 3.3 depicts a typical Polish longwall section, which actually comprises two individual longwall panels operated off of a single split of intake ventilation.

Figure 3.4 depicts two of several configurations observed for the cross sectional area of Polish development headings. The steel arches used in development headings are usually spaced at approximately 1 m apart, although 0.5 m spacing is used on main development headings that are expected to be used for many years. Main development headings devoted to conveyor haulage would have only the supporting arches and lagging; a conveyor; the associated water, electric, and communications lines; and possibly a drainage ditch. In most Polish mines, coal is normally conveyed to a dedicated skip hoist shaft, while miners and materials use another shaft and are transported to working sections by rail.

The Polish longwall system typically removes all the coal possible to comply with Government regulations mandating full recovery of the resource, and also to evenly subside the surface. In some instances, the gob areas behind Polish longwalls are used for hydraulic or pneumatic stowage of sand, powerplant ash, or

TABLE 3.1
Case I: Longwall Mine Operating Data

	U.S. Coal Mine Range	Polish Coal Mine Range
Annual Production, at full capacity (metric tons raw coal)	2,000,000 - 4,100,000	1,300,000 - 8,600,000
Annual Production, at full capacity (metric tons clean coal)	1,400,000 - 2,300,000	1,140,000 - 7,380,000
Seam Height (meters)	1.25 - 1.77	1.71 - 6.10
Number of Active Seams	1	3 - 12
Operating Days/Year	240 - 242	226 - 252
Mine Productivity* (metric tons raw coal per person-hour)	2.71 - 2.98	0.26 - 0.71
Overall Productivity** (metric tons clean coal per person-hour)	1.37 - 1.64	0.18 - 0.54
Total Employment at Full Production**	354 - 691	2,202 - 7,823
Shift Length (hours)	8	6.0 - 7.5
Number of Shifts/Day	2 - 3	3 - 4
Production Work Schedule (days on/days off)	5/2	5/2
Yield (clean coal tons/raw coal tons; percent)	50 - 67	51 - 89

* Includes all personnel associated with the operation of the mine, including labor, supervision, and staff. Does not include any corporate or division overhead.

** Includes all personnel associated with the operation of the mine and preparation plant including labor, supervision, and staff. Does not include any corporate or division overhead.

Figure 3.2
Typical U.S. Longwall Panel Layout
(Not to Scale)

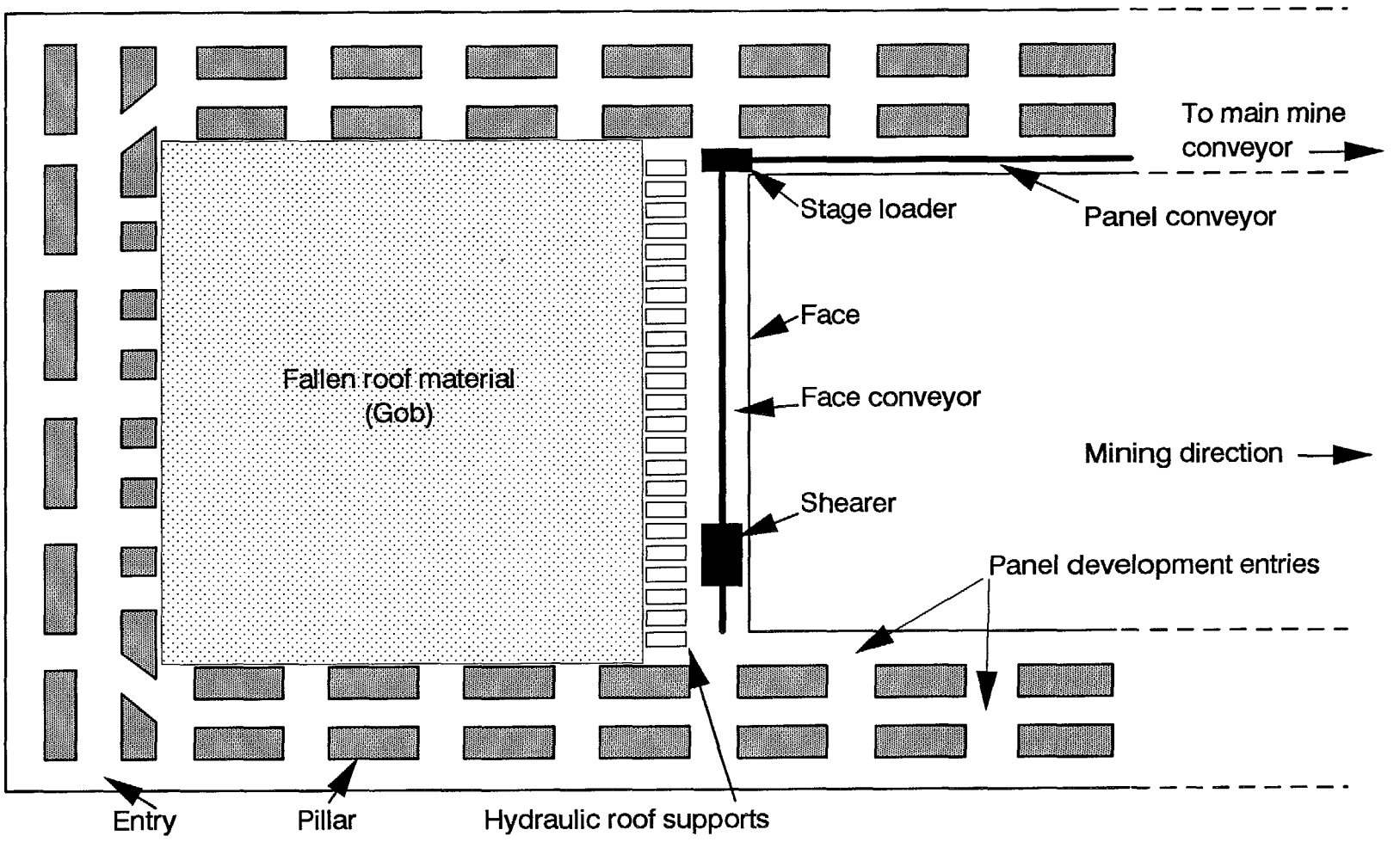


Figure 3.3
Typical Polish Longwall Section Layout
(Not to Scale)

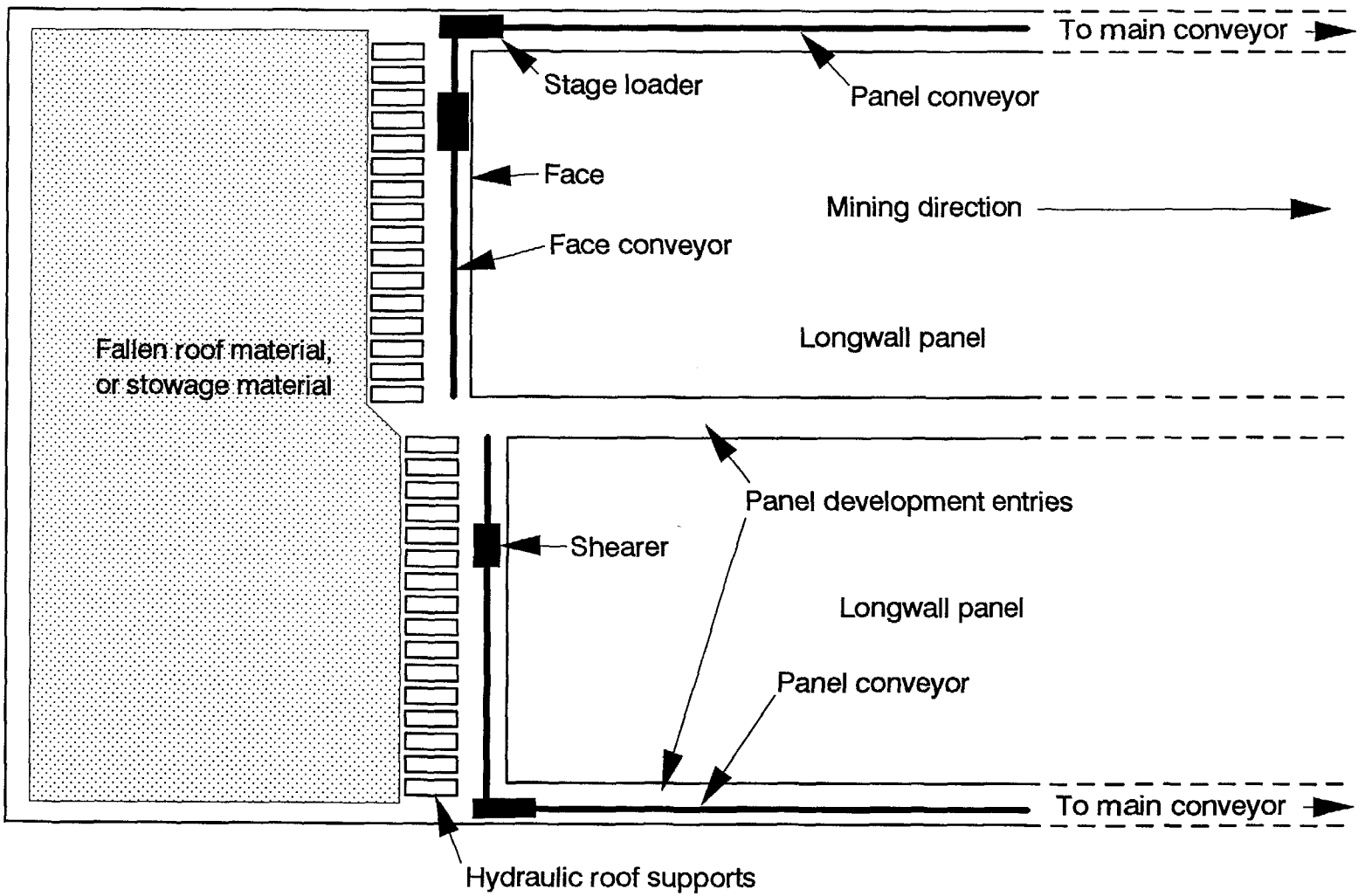
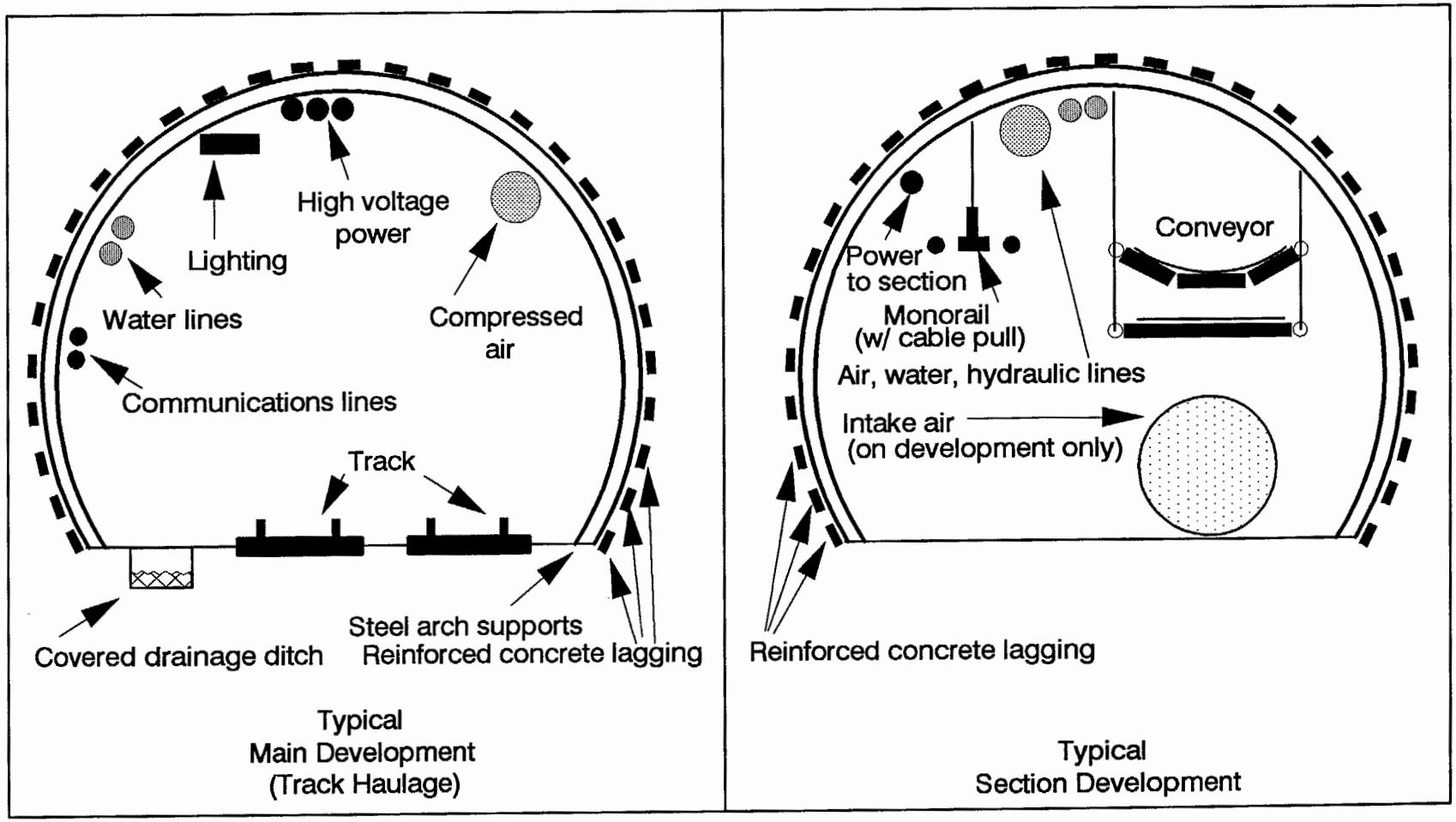


Figure 3.4
Typical Cross Section
of Polish Development Entries
(Not to Scale)



preparation plant refuse. This is either to minimize subsidence of the surface, dispose of excess waste materials, or so that a multiple pass with the longwall can be taken on the seam being mined. Stowage of powerplant ash can generate significant revenue (up to $1.00/metric ton of ash) for the mine disposing of the waste.

The eight Polish mines differ from the U.S. mines principally in the thickness of the coal seam mined. The seam heights for the Polish mines are generally higher than that encountered in the U.S. mines, although Polish mines are required by statute to recover considerably thinner seams than those encountered in the mines examined in this study. By law, coking coal seams as thin as 0.5 m and steam coal seams as thin as 0.8 m are supposed to be recovered. The Polish operations also tend to be larger operations in terms of labor force, numbers of longwall faces and overall production, but a few of the mines examined had less production than the U.S. mines.

The basic mining cost ranges for Case I are shown in Table 3.2, in average 1989 U.S. dollars. The figures represent the costs to extract 1 metric ton of raw coal at a zero and 15 percent DCFROR. The results and findings by cost categories follow.

Capital Cost -- The ranges in the capital costs for both the U.S. and Polish mines reflect the amount of undepreciated capital and the reinvestment required over the period of the study to maintain production. At a zero percent rate of return, the capital cost for the U.S. mines is from 7 to 11 percent of total mine cost, and for the Polish mines the range is from 19 to 44 percent. While the U.S. mines have generally a greater amount of undepreciated capital than the Polish mines, the latter have higher reinvestment requirements because of lower productivity and significantly shorter service life of Polish production equipment. At least part of the lower productivity in the Polish mines is due to the practice of driving development headings in rock using roadheaders: very little coal production results until the panel development is completed. In U.S. mines, the use of continuous miners on the development headings contributes much higher amounts of production. The lower amount of undepreciated capital in the Polish mines results from the age of the mines and the shorter depreciation schedules for most face equipment. The Polish mines examined are more than 30 years old (1989) on average, while the U.S. mines are approximately 18 years old on average. The greater age of the Polish mines means that much more of the shaft and initial development work and plant are already fully depreciated.

Mine Operating Cost -- Mine operating costs (labor plus equipment and supplies) for the U.S. mines are generally higher

TABLE 3.2
Case I: Longwall Mines Cost Comparison
Detailed Cost Summary
(1989 U.S. dollars per metric ton raw coal)

Cost Category at Zero Percent DCFROR	U.S. Range	Polish Range
Capital Cost	1.01 - 2.36	2.17 - 11.72
Return of equity capital	1.01 - 2.36	2.17 - 11.72
Mine Operating Cost	11.88 - 27.44	5.60 - 14.85
Labor	6.62 - 15.31	4.36 - 9.02
Equipment and supplies	5.25 - 12.13	1.24 - 5.83
Land Costs	0.00 - 0.74	0.00 - 0.00
Royalties	0.00 - 0.74	0.00 - 0.00
Taxes and Penalties	0.95 - 2.28	1.12 - 3.52
Federal income	0.03 - 0.04	0.27 - 1.32
State income	0.00 - 0.00	0.00 - 0.00
Property and ad valorem	0.03 - 0.54	0.00 - 0.00
Severance	0.19 - 0.80	0.00 - 0.00
Black lung fees	0.61 - 0.79	0.00 - 0.00
Abandoned mine lands fee/reclamation fund	0.09 - 0.11	0.00 - 0.03
Geological fund	0.00 - 0.00	0.03 - 0.06
Science and technology	0.00 - 0.00	0.07 - 0.14
Coal Board	0.00 - 0.00	0.01 - 0.04
Property insurance	0.00 - 0.00	0.01 - 0.03
Subsidence	0.00 - 0.00	0.16 - 1.15
Environmental protection	0.00 - 0.00	0.02 - 0.33
Miscellaneous	0.00 - 0.00	0.42 - 1.55
Total Cost	14.81 - 32.08	9.19 - 26.51
Cost Category at 15 Percent DCFROR		
Capital Cost	1.80 - 4.30	2.78 - 20.33
Return of equity capital	1.01 - 2.36	2.17 - 11.72
15 Percent return on capital	0.78 - 1.93	0.58 - 8.61
Mine Operating Cost	11.88 - 27.44	5.60 - 14.85
Labor	6.62 - 15.31	4.36 - 9.02
Equipment and supplies	5.25 - 12.13	1.24 - 5.83
Land Costs	0.00 - 0.79	0.00 - 0.00
Royalties	0.00 - 0.79	0.00 - 0.00
Taxes and Penalties	1.43 - 4.05	1.64 - 7.81
Federal income	0.22 - 0.79	0.65 - 6.45
State income	0.03 - 0.13	0.00 - 0.00
Property and ad valorem	0.03 - 0.54	0.00 - 0.00
Severance	0.19 - 0.87	0.00 - 0.00
Black lung fees	0.61 - 0.82	0.00 - 0.00
Abandoned mine lands fee/reclamation fund	0.09 - 0.11	0.00 - 0.03
Geological fund	0.00 - 0.00	0.03 - 0.06
Science and technology	0.00 - 0.00	0.08 - 0.19
Coal Board	0.00 - 0.00	0.01 - 0.04
Property insurance	0.00 - 0.00	0.01 - 0.03
Subsidence	0.00 - 0.00	0.16 - 1.15
Environmental protection	0.00 - 0.00	0.02 - 0.33
Miscellaneous	0.00 - 0.00	0.42 - 1.55
Total Cost	15.91 - 34.68	10.12 - 40.35

Note: Totals may not add because they represent the costs at an individual mine. Cost components within a column may be from several different mines to illustrate the minimum or maximum value for each respective cost component among the mines. All costs are rounded to the nearest cent. Exchange rate used: Zl 1,446 = US $1.00.

than for Polish mines because of generally higher labor costs and equipment and supply costs. At zero percent DCFROR, the mine operating costs were from 80 to 86 percent of the total mine-mouth cost of raw coal for the U.S. mines and from 46 to 72 percent of the mine-mouth cost for the Polish mines. The differences in labor and equipment and supply costs are apparent in Figures 3.5, 3.6, and 3.7. As shown in Table 3.1, even though the U.S. mines range in raw coal productivity per person-hour of 2.71 to 2.98 mt is much higher than that of the Polish mines range of 0.26 to 0.71, the much lower wage rates in Polish mines gives them an advantage in total labor costs.

The cost of equipment and supplies, primarily replacement parts and consumable items such as timber, roof bolts and steel arches, is generally higher in U.S. mines. The most plausible explanation is that the command-type pricing policies, which continued to exist in 1989 in Poland regarding raw materials such as timber and steel sets, caused most of the difference. It is also possible that the multiple-entry system used in the U.S. could be contributing to the difference because U.S. mines must develop roughly three times as many entries to bring a longwall panel into production. Also, the roof bolts in U.S. mines are not recovered. Approximately half of the steel arches used in the panel development entries of Polish single-entry longwall system are recovered and reused.

Land Cost -- There were no land costs for the Polish mines in this study. The Polish Government does not yet charge royalties or lease rents. The U.S. mines paid royalties ranging from zero to 5 percent of the mine-mouth price of the coal. These royalties are for the lease of privately owned coal lands, a situation typical of coal operations in the Eastern United States. One mine paid no royalties because it has owned the land outright for decades, the others paid lease royalties for part or all of the land on which the mines were located.

Taxes and Penalties -- Tax and penalty costs were generally higher, and consumed a higher percentage of the total mine-mouth cost, for the Polish mines than for the U.S. mines. At zero percent DCFROR, taxes and penalties accounted for 9 to 23 percent of the mine-mouth price of the Polish coal and 6 to 8 percent of the mine-mouth price of the U.S. coal. For the Polish mines, the most significant line items were the Federal income tax, subsidence damage assessments, penalties for environmental protection (for discharge of mine waters into surface waters), and miscellaneous nonmaterial charges, which include penalties for regulatory infractions.

The Federal income tax for the Polish mines is significant at zero percent DCFROR because of the uneven cash-flows over the period of the study. Several of the mines incur significant negative cash-flows in the first few years of the analysis

Figure 3.5

CASE I: Longwall Coal Mines

Component Costs at Average 1989 Exchange Rates,
0 Percent DCFROR

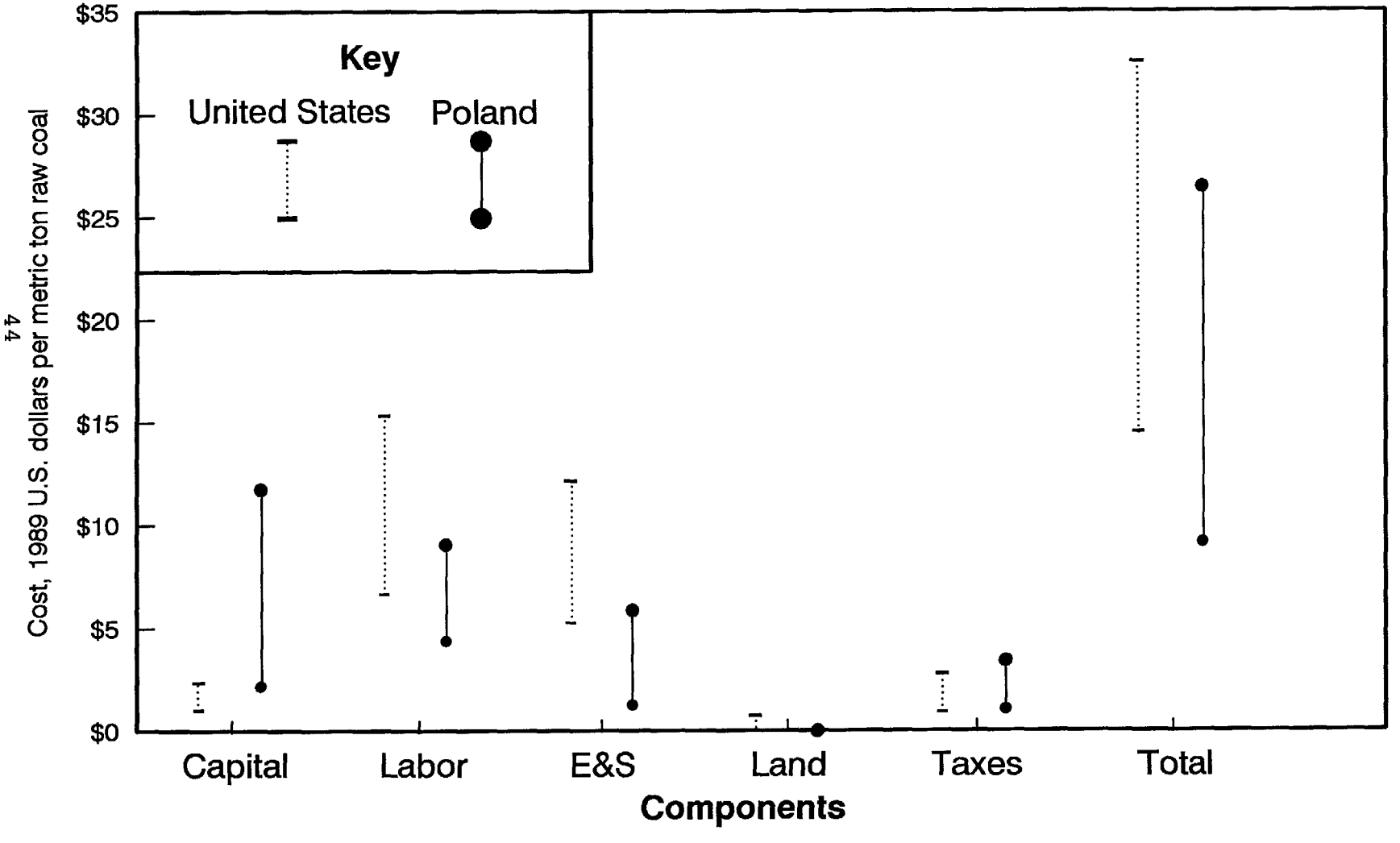


Figure 3.6

CASE I: Longwall Coal Mines

Component Costs at Average 1989 Exchange Rates,
15 Percent DCFROR

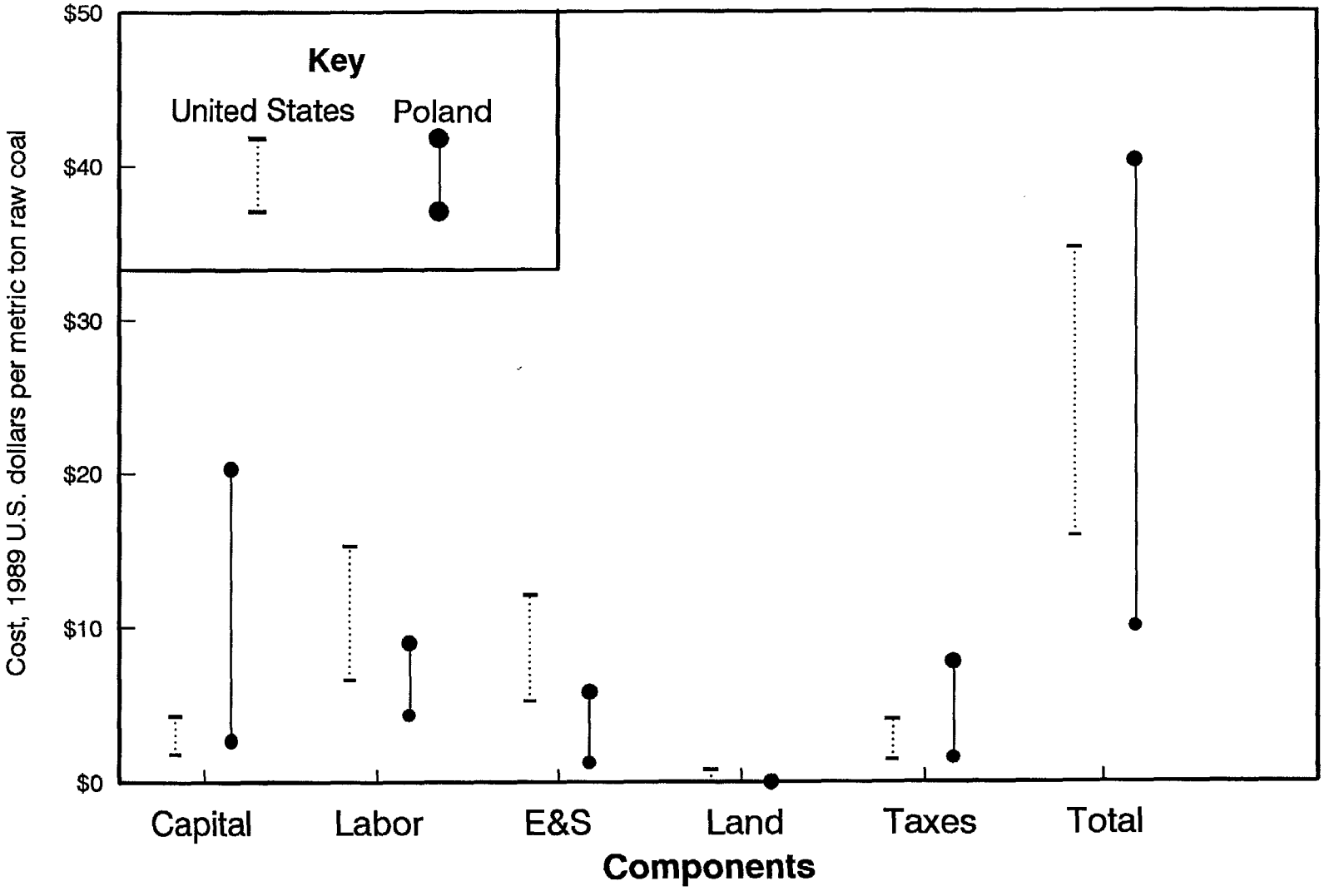
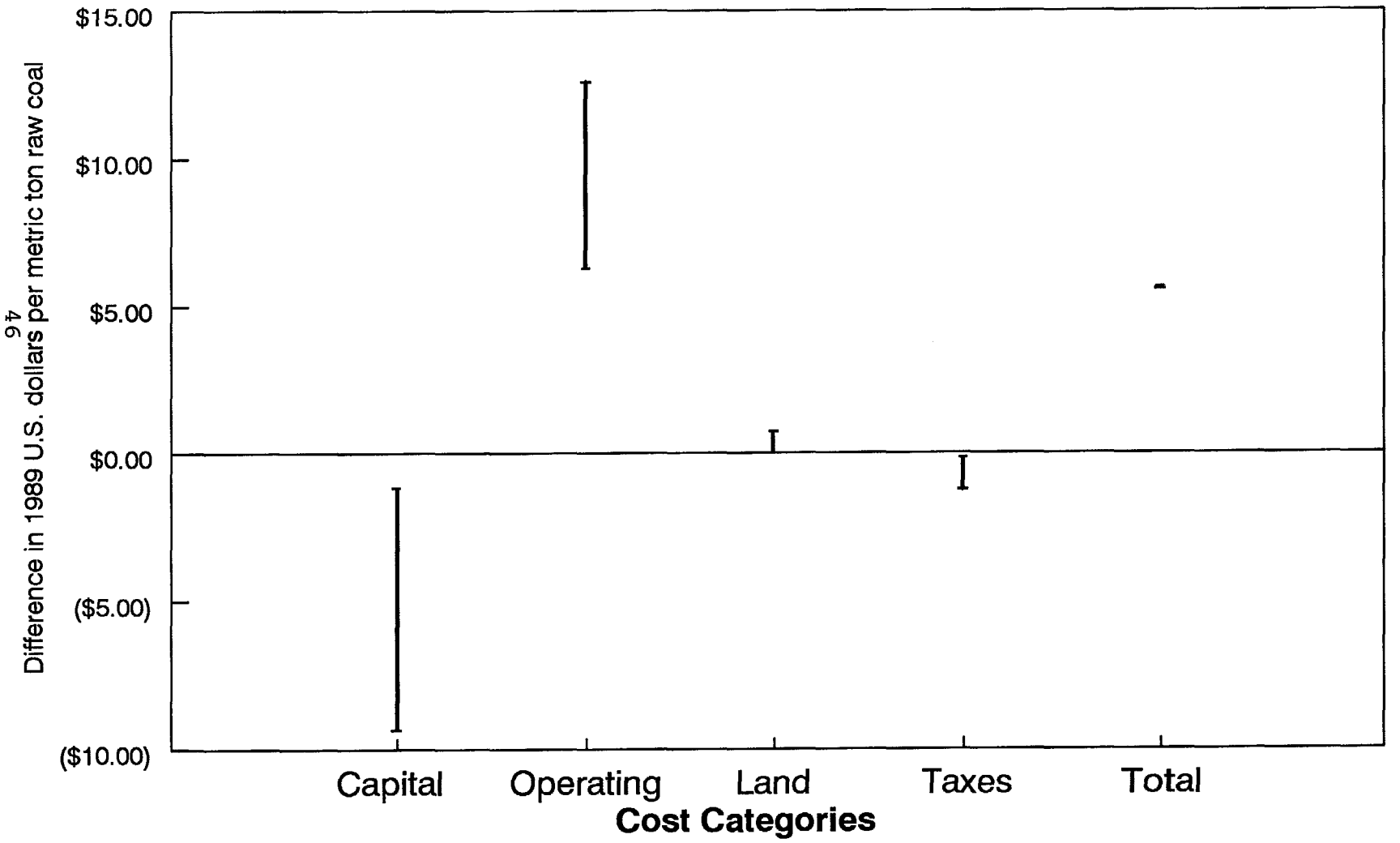


Figure 3.7
CASE I: Longwall Coal Mines
Relative Difference in Minimum/Maximum Cost Ranges
Cost Component Differences, 0 Percent DCFROR
(U.S. Mine Cost - Polish Mine Cost)



because of new development, such as ventilation shafts, which must be recovered in later years. The positive income in later years is taxed at a rate of 40 percent by the Central Government. Federal and State income taxes are relatively insignificant for the U.S. mines at zero percent DCFROR, together amounting to only 0.2 percent at most.

While the Polish reclamation fund and the U.S. Abandoned Mine Lands Fund are roughly equivalent, there are no taxes in the U.S. system comparable to the Polish Geological fund assessment, Science and Technology assessment, Coal Board fund or any of the penalty assessments. At zero percent DCFROR, the significant tax items, other than income tax, for the U.S. mines are the local property and ad valorem taxes, State severance taxes, black lung fees, and the abandoned mine lands fee. These taxes account for 5 to 8 percent of the total U.S. mine-mouth cost at the zero percent DCFROR. The Polish reclamation fund assessment, Science and Technology fee, Coal Board fund, and Geological fund assessments accounted for 0.5 to 1.7 percent of the Polish mine mouth costs.

At 15 percent return, the tax costs for the majority of the Polish mines examined are approximately equal to the taxes imposed on U.S. mines. The only taxes which change at 15 percent return for the Polish mines is the Federal income tax and the science and technology fee. The Polish penalty assessments are not levied on the basis of mine income, therefore they do not change at higher rates of return. The U.S. Federal, State, and severance taxes all increase as the return increases. In the case of one U.S. mine, the black lung tax increases to its maximum statutory level per ton as the price of the coal increases. At 15 percent DCFROR, Federal income taxes account for 1 to 4 percent of total mine-mouth cost for the U.S. mines and 6 to 16 percent of total mine-mouth costs for Polish mines. The total for taxes and penalties, at 15 percent DCFROR, is 9 to 12 percent of mine-mouth cost for U.S. mines and 13 to 25 percent of the mine-mouth cost for Polish mines.

Selected Health, Safety, and Environmental Compliance Costs -- The ranges in costs of certain health, safety, and environmental regulations are compiled in Table 3.3. Compliance costs that could be isolated and computed for the U.S. mines are mandatory training, productivity changes, equipment modifications, personal equipment and safety facilities, black lung (pneumoconiosis) tax, water treatment, and reclamation fees. For the Polish mines, the declared health, safety, and environmental costs as listed in the official accounting books of the mines are presented.

The costs of individual tax items related to health and safety research (the Science and Technology fee), and environmental taxes (the reclamation fund), as well as noncompliance penalties for subsidence and environmental protection are also included.

Penalties levied on the U.S. mines for health, safety, and environmental infractions, if any, were not accounted for in this study.

The costs of complying with the selected health and safety regulations for the U.S. mines range from $2.30 to $4.20/mt; for the Polish mines the range is from $0.16 to $0.52/mt. The major differences between the U.S. and Polish mine health and safety costs is the estimated productivity change calculated for the U.S. mines, and the black lung tax. Together, these items account for $1.93 to $3.85 of the U.S. health and safety regulatory costs.

TABLE 3.3
Selected Regulatory Costs For Case I Mines
Zero Percent DCFROR
(1989 U.S. dollars per metric ton raw coal)

	U.S. Range	Polish Range
Mine Health and Safety	2.30 - 4.20	0.16 - 0.52
Training/H&S in the colliery	0.04 - 0.10	0.08 - 0.38
Productivity changes	1.32 - 3.06	0.00 - 0.00
Equipment modifications	0.10 - 0.25	0.00 - 0.00
Personal equipment and safety facilities	0.01 - 0.06	0.00 - 0.00
Black lung tax	0.61 - 0.79	0.00 - 0.00
Science and technology tax	0.00 - 0.00	0.07 - 0.14
Environmental	0.09 - 0.11	0.40 - 1.39
Abandoned mine lands/ reclamation fund	0.09 - 0.11	0.00 - 0.04
Subsidence assessments	0.00 - 0.00	0.16 - 1.15
Environmental protection	0.00 - 0.00	0.02 - 0.33
Waste and effluent disposal	0.00 - 0.00	0.18 - 0.38
Total	2.41 - 4.31	0.59 - 1.67

Note: Total regulatory costs cover only the activities shown and these costs do not include any indirect costs that are affected by regulation (e.g., Federal income taxes). Totals may not add because they represent the costs at an individual mine. Cost components within a column may be from several different mines to illustrate the lowest to highest value for each respective cost component among the mines. Exchange rate used: Zl 1,446 = US $1.00.

Training is mandatory for both U.S. and Polish mine workers. The cost listed by the Poles as health and safety in the colliery probably incorporates not only training, but elements of equipment modification, personal protection devices, and safety

facilities as well. Both the United States and Poland require new employees to receive training in first aid, fire protection, self-rescuer use, and common hazard recognition. Both industries also conduct periodic refresher and maintenance training for employees, although responses from the Polish mines in this study indicate significant differences among mines in refresher training schedules. Initial training is more intensive in the U.S. industry than that practiced by the Poles (40 hours versus 8 hours). For a more detailed discussion of training programs and their costs to Polish mines, refer to Appendix C.

Productivity changes are the costs associated with the loss of production due to special work requirements imposed by mandatory health and safety standards. Interruptions to production cycle include such activities as inspections by company or Government officials, rest periods for working in elevated temperatures, hanging ventilation curtains close to the working face, checking and documenting methane and air flow measurements, and mechanically checking installed roof bolts.

Based on a number of U.S. industry studies of underground mines, this analysis assumes that a productivity penalty of 20 percent is incurred as a result of complying with health and safety regulations. Since comparable studies of Polish mines were unavailable, the only mandatory compliance activity that appears under this line item for the Polish mines is the hot room requirement that limits work at the face to 4 hours maximum when ambient temperatures are at or above 28° C at the work area. Although there is a productivity loss connected with adhering to Polish health and safety regulations, it could not be quantified by Bureau personnel.

The black lung tax is a major regulatory compliance cost for U.S. mines. In 1978, Congress enacted legislation establishing a special trust fund to compensate miners who have become permanently disabled by pneumoconiosis (which includes black lung) or other respiratory diseases caused by inhaling coal and rock dust. In 1985, Congress raised the black lung trust fund tax to $1.10/short ton ($1.21/mt) of salable coal mined by underground methods, and for surface-mined coal $0.55/short ton ($0.61/mt) of salable coal. The amount of tax may not exceed 4.4 percent of the price received by the producer. Lignite mines are exempt from the tax. Polish miners receive state medical care for pneumoconiosis.

The Science and Technology levy imposed on the Polish coal industry has no equivalent in the U.S. This levy goes to the Central Fund for Development and Science and Technology, and is used by the Government to fund the Science and Technology Institute's research and development for economic and technical progress. A portion of the proceeds also is allotted to the

Central Computing Institute, which is responsible for most of the hard coal mines cost accounting and statistical record keeping. The Science and Technology fee is levied as a percentage of all revenues and was increasing throughout 1989; the rate used in this study was the average 1989 rate for each individual mine, which was approximately 0.66 percent of revenues for the mines studied. In 1990, the rate was increased to 1.2 percent of revenues.

In this analysis, the costs associated with environmental activities is limited to the Abandoned Mine Lands fee on the U.S. side, while the Polish costs include the reclamation fund, subsidence assessments, environmental protection penalties for air and water emissions, and declared waste and disposal costs. The cost of waste and effluent disposal is included for the Polish mines because this typically entails not only the cost of operating mine dumps but also any water treatment costs incurred by the mines.

The largest environmental costs to the Polish mines typically consisted of either subsidence assessments or environmental protection penalties for air and water emissions. Subsidence assessments are levied by local committees; the environmental protection penalties are levied by the Ministry of Environmental Protection and Natural Resources. For more details on how these assessments are determined, see Appendix A. On a raw coal basis, some of these charges were substantial for the Polish mines, accounting for as much as $1.15/mt of raw coal, or 8 percent of the total mine-mouth costs.

The U.S. Abandoned Mine Lands reclamation fee was established in 1977 by Congress as part of the Surface Mining Control and Reclamation Act (SMCRA), which set national standards for reclaiming lands disturbed by surface coal mining. The fee, to be used to reclaim land and water resources adversely affected by past mining operations when no responsible parties are available, was set at $0.15/short ton (about $0.17/mt) of salable coal extracted by underground methods. For coal mined by surface methods, the fee was set at $0.35/short ton of salable coal, or 10 percent of the mine-mouth value of the coal, whichever is less. The reclamation fee for lignite coal was set at a rate of 2 percent of the mine-mouth value or $0.10/short ton ($0.11/mt), whichever is less. The Polish equivalent, the Reclamation fund fee, is also levied on a tonnage basis. It is used to restore the grounds to a pre-mining appearance and manage the waste dumps. Like many of the other Polish taxes and fees, this fee rose considerably during 1989; the average levy for the mines studied for 1989 was approximately Zl 47 ($0.03)/mt. The average levy during December 1989 was approximately Zl 117 ($0.08)/mt.

The total regulatory costs isolated in this analysis range from $2.41 to $4.31/mt for the U.S. mines and from $0.59 to

$1.67/mt for the Polish mines. The major cost items accounting for this difference are productivity changes (not estimated for the Polish mines) and the U.S. black lung tax.

Total Cost -- For the U.S. longwall mines in Case I, the range in basic mining cost at zero percent return is from $14.81 to 32.08/mt, compared with $9.19 to 26.51/mt for the Polish mines. At 15 percent return, the U.S. mines have a total cost of $15.91 to $34.68/mt, while the Polish mines have a total cost range from $10.12 to $40.35/mt. As illustrated in Figure 3.7, the Polish mines generally have around a $5.60/mt cost advantage over the U.S. mines. U.S. mines have higher operating and land costs, and lower capital and tax costs.

Significance of Case Study Findings

The findings of the underground longwall case study show that basic mining costs for relatively similar mines are lower in Poland than in the United States.

Polish longwall mines generally have a mine-mouth cost advantage of approximately $5.60/mt of raw coal at zero percent rate of return. The cost advantage is not absolute; there is considerable overlap of the ranges between the U.S. and Polish mining costs at both rates of return. At 15 percent DCFROR, the highest cost mine is Polish, which has costs approximately $5.67 higher than the U.S. maximum cost mine.

The main cost advantages the Polish longwall mines have are lower mine operating and land costs. While the U.S. mines have significantly higher productivity than their Polish counterparts, labor costs in the U.S. mines are generally higher. In addition, material and supply costs are almost always higher in U.S. mines. Although the demonstrably higher productivity of the U.S. mines partially offsets the higher wage rates, the net result, when equipment and supply costs are added, is higher operating costs for the U.S. mines compared with similar Polish mines.

Land costs for U.S. mines are also generally higher, as Polish mines are not yet required to pay production royalties.

Capital costs for the Polish mines are consistently higher for a number of reasons. Both lower productivities and more rapid turnover of the Polish equipment result in higher capital charges per ton than incurred in U.S. mines. Existing Polish practices in equipment warehousing, storage, and scheduling also contribute to higher capital costs. Finally, the existing practice of the single-entry longwall system using roadheaders to drive development headings, much of the time in rock, appears to contribute to the comparative capital cost disadvantage of the Polish mines because of the relatively small amounts of salable product generated during development.

Tax and penalty costs for the Polish mines are generally higher than for U.S. mines, particularly at 15 percent DCFROR. The Polish industry does not have taxes equivalent to the U.S. black lung tax or State severance taxes. But, the higher Federal income tax rate and the substantial subsidence, environmental protection, and miscellaneous nonmaterial charges on production cause the Polish mines to incur generally higher taxes than their U.S. counterparts. The generally higher capital costs incurred by the Polish mines also tends to exacerbate the higher income tax rate at positive rates of return.

Polish mines have somewhat lower regulatory costs than U.S. mines, if the estimated U.S. productivity penalty is included. Regulatory costs are from $0.74 to $3.72/mt higher for the U.S. mines than for the Polish mines. However, without the estimated productivity penalty (which was included only for the United States), the U.S. mines would have only slightly higher health and safety regulatory costs ($0.46 to $0.98/mt higher) than Polsh mines. Also, the U.S. mines have significantly lower envrionmental costs ($0.29 to $1.30/mt lower). Overall, without the estimated productivity penalty, the total regulatory costs for U.S. and Polish mines would be fairly comparable, from $1.09 to $1.25/mt for the U.S. mines and from $0.59 to $1.67/mt for the Polish mines.

CHAPTER 4

RELATIVE COMPETITIVENESS IN SELECTED MARKETS

Introduction

This chapter examines the relative competitiveness of Polish and U.S. mines producing coals of similar quality and competing in two markets in the United Kingdom: the utility steam coal market and the metallurgical coal market. Although the qualities of the coal from the mines in each case study are generally similar, the mining geology, type of mine, annual production, and mining plans vary significantly among the mines. U.S. mines of all types, underground and surface, that compete in the U.K. markets, were used in the market analysis.

Competitiveness in International Coal Markets

Competitiveness in international coal trade is difficult to define in explicit terms. Delivered price is certainly the major factor, but there are others—such as consistent quality, security, and reliability of supply—that are important to most coal buyers. In these case studies on relative market competitiveness, only delivered costs are analyzed.

Delivered cost consists of two major cost components. The first is the cost to produce a metric ton of salable coal at the mine's shipping point, which is usually the rail loadout (the mine-mouth cost). The other is the cost to transport a metric ton of coal to the buyer. Transportation cost includes the cost of transporting the coal to an export terminal, port terminal service charges, the cost of ocean transport to the receiving port, and other applicable costs to move the coal from the receiving port to the power or coking plant's stockpile.

The mine-mouth cost is dependent upon a large number of factors as was shown in Chapter 3. Some of these cost factors are (to a degree) controllable by the mine operator; others are primarily determined by coal seam geology, location of the coal deposit, and government policies and regulations.

Mine management has some control over capital and operating costs. Governments control regulatory compliance costs and taxes. The main cost items in this category are Federal, State, and local regulatory requirements, taxes, royalties, and fees.

The cost of transporting coal to an export terminal is a function of the distance the mine is from the port, type of transport mode; and degree of intra- and inter-modal competition that exists. Inland transportation usually involves movement by truck, rail, barge, or any combination thereof.

Ocean shipping cost is a function of the bulk capacity of the vessel, the distance from the exit to receiving port, the type of service contract under which the shipment is made, and the loading and unloading facilities at the coal ports. The first two factors are the most significant in determining the freight rate for any particular shipment.

Because most international coal purchases are made in U.S. dollars, a major factor determining the relative competitiveness of U.S. coal is the value of the dollar relative to the country currency of competing suppliers. At the time this competitive analysis was made (1989) US $1.00 was worth approximately Zl 1,446.

Methodology and Analysis

The methodology for calculating the mine-mouth cost is identical to that outlined in Chapter 3, except that the costs of preparing the coal for the market are added to the basic mining cost. For Cases II and III, the mine-mouth cost is the average cost to produce 1 metric ton of salable coal over the 20-year period of analysis.

These market competitiveness cases compare mine-mouth costs only at zero percent rate of return, as this is the break-even point for a mine. The zero percent return represents a gross sales revenue received at the mine equal to the mine-mouth cost. This cash-flow will cover all operating costs and pay back any equity capital invested.

Transportation costs in this study are the prices paid by the shipper and not the actual costs of the transportation service. The transportation costs are estimates based on the most economical mode and route. These estimates were selected after interviewing purchasing personnel, railroad service managers, mining company personnel, shipping agents, and coal brokers and traders with expertise in the selected markets in this study. For the Polish mines in this study, the only viable transportation alternative was to rail the coal to one of the coal facilities on the Baltic Sea. All overseas shipments, or about half of all the Polish exports, use this alternative. The rest of the exports are railed directly to customers in adjacent countries.

The transportation cost figures represent the actual or typical costs that would have been incurred by a shipper in 1989 in moving coal from a specific mine to a customer. Shipping costs were obtained or estimated using information from a variety of sources: industry trade publications; published rail tariffs; U.S. Bureau of Mines site reports; truck, rail, barge, steamship, and stevedore companies; terminal and mine operators; and port

authorities. Polish rail tariffs reflect published tariffs for unit trains with car sizes of approximately 50 metric tons.

The delivered costs in this study must be viewed in the context of the bases used in their computation. The mine-mouth cost is the average cost of production for the period from 1989 through 2008. Transportation costs are time specific and can fluctuate substantially over short periods. Exchange rates and inflation rates for a specific country and currency are also time specific and subject to wide variations. Consequently, delivered costs in U.S. dollars, particularly for foreign coal suppliers, can vary substantially over time.

Case II: European Electric Utility Market

The European electric utility market is a significant and growing coal import market. For this analysis, a steam coal import facility in the United Kingdom was chosen because of its rapidly growing imported steam coal market. Much of the increase in imports in the United Kingdom came only very recently, in 1991, because of the privatization of the electricity generators and their new-found freedom to choose low-cost fuel sources. Both Poland and the United States export coal to this market. From 1990 to 1991, United Kingdom imports of steam coal jumped from 5.4 Mmt to 9.2 Mmt. United Kingdom powerplants are mainly designed to burn medium-sulfur, medium-to-high Btu bituminous coals. In the future, they are expected to import significant amounts of low sulfur bituminous coals for blending with domestic coals to reduce their sulfur dioxide emissions. Relatively few of the United Kingdom electric power plants are currently equipped with scrubbers.

In this case, five Polish mines from Case I are compared with three U.S. mines located in Kentucky and West Virginia. The remaining three Polish mines from Case I were not included in Case II because they did not ship their coal overseas (the coal quality generally was not high enough to warrant shipment to the United Kingdom market). They could probably export to overseas customers if significant investments in coal washing facilities were made; however, that analysis is beyond the scope of this study. These three mines do export their coal to customers on the European continent, primarily to the Commonwealth of Independent States (the former Soviet Union).

The Polish mines all use the single-entry longwall production method. The mines produce from 1.3 to 5.8 Mmt of salable coal per year. The yield of clean coal to raw coal production is from 51 to 89 percent. All of the Polish mines rail the coal from 511 to 609 km to ports on the Baltic Sea. The two largest Polish coal ports, Gdansk North Port and Swinoujscie, were chosen as the point of export because they had the ability to handle Panamax-size vessels or larger. Ships of this size, loading at the other

Polish ports, normally top off at Gdansk North Port or Swinoujscie. This analysis assumes Panamax vessels take the coal to the United Kingdom receiving port, which can only accommodate Panamax-size vessels or smaller. The ocean shipping distance to the United Kingdom receiving port ranges from 2,738 km to 2,903 km, depending on whether the shipment is from Swinoujscie or Gdansk, respectively.

The U.S. mines use conventional, longwall and surface mining methods to produce from 1.5 to 2.7 Mmt of salable coal per year. The yield of clean coal to raw coal production ranges from 50 to 67 percent. Two mines in this case are located in Kentucky; one is an underground mine using the conventional system (drilling, blasting, and loading), and the other mine is a multiple-seam surface operation using a modified mountain-top-removal mining method. The third U.S. mine is an underground longwall operation in West Virginia.

Coal from one Kentucky mine is railed approximately 780 km to a terminal in the Hampton Roads area, where it is loaded on Panamax vessels for shipment to the United Kingdom. The shipping distance from Hampton Roads to the United Kingdom receiving port is approximately 6,060 km. The other Kentucky mine rails the coal approximately 83 km to a river terminal, where it is loaded on barges and shipped to a New Orleans coal terminal. The West Virginia mine also ships its coal down the river system to New Orleans, but it has the added advantage of having a river loadout facility. At New Orleans, the coal from both the West Virginia and Kentucky mines is loaded into Panamax vessels and shipped approximately 8,490 km to the United Kingdom receiving port.

Delivered Cost Comparisons and Findings -- The delivered costs for the U.S. and Polish mines are compared in Table 4.1 and Figure 4.1. Typical 1989 delivered costs for the Polish mines ranged from $40.45 to $55.84/mt and for the U.S. mines, from $46.25 to $75.65/mt. In this case, the Polish mines delivering coal to the United Kingdom have a generally lower delivered cost of at least $5.80/mt, due entirely to the difference in transportation costs. Total production costs, including taxes and penalties, are similar for the U.S. and Polish mines. The side-by-side comparison in Figure 4.1 shows the overlap in delivered cost for the Polish and U.S. mines. The wide range in delivered cost for the U.S. coal is due to the mix of surface and underground mines, as well as the different transportation routes.

Total mine-mouth costs for the Polish and U.S. mines show a general similarity, although the U.S. mines generally have higher production costs, and the Polish mines have much higher tax and penalty costs. The Polish export tax (20 percent of the f.o.b. price, port of exit) accounts for a significant portion of the Polish costs. However, even without the export tax, the Polish

tax burden is still generally higher than that in the United States.

Total transportation costs for the Polish and U.S. mines show a consistent geographical advantage for the Polish mines. The Polish mines also have lower ocean freight costs, as their shipping distances are half or less than the U.S. shipments.

This case illustrates that the production cost and geographical advantage of the Polish mines is sufficient to enable them to be competitive with U.S. mines in the United Kingdom market. The higher costs incurred by the Polish mines in taxes are offset by lower production costs and transportation charges.

TABLE 4.1
Case II: European Electric Utility Market
Delivered Cost Summary
(1989 U.S. dollars per metric ton salable coal)

Cost Category at Zero Percent DCFROR	U.S. Range	Polish Range
Total mine-mouth cost	25.30 - 55.73	27.88 - 42.55
Production*	20.64 - 51.18	14.61 - 27.44
Land, taxes, and penalties	4.55 - 5.84	12.55 - 15.11
Transportation	19.92 - 25.94	12.57 - 13.28
Trucking (from mine)	0.00 - 0.00	0.00 - 0.00
Rail rate	0.00 - 19.19	5.70 - 6.22
Barge rate	0.00 - 9.37	0.00 - 0.00
Port charges	0.00 - 1.80	1.73 - 1.81
Ocean freight	6.75 - 8.75	4.95 - 5.25
Total Delivered Cost	46.25 - 75.65	40.45 - 55.84

* Production cost includes all capital and operating costs for both the mine and preparation plant.

Note: Totals may not add because they represent the costs at an individual mine. Cost components within a column may be from several different mines to illustrate the minimum or maximum value for each respective cost component among the mines. Exchange rate used is Zl 1,446 = US $1.00

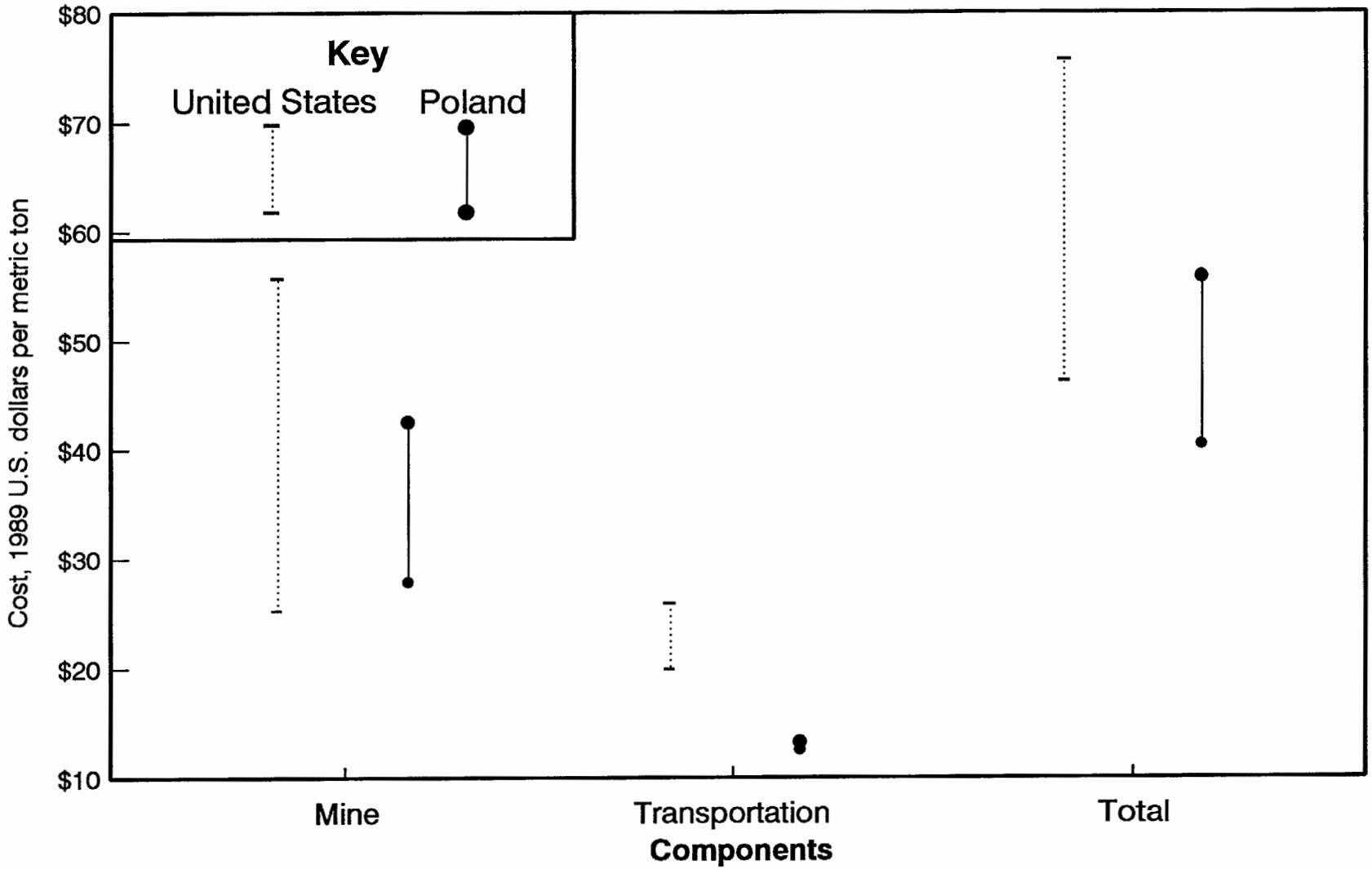
Case III: European Metallurgical Coal Market

The European metallurgical coal market is one of the larger and more competitive coal markets. In 1989, European Community steel mills imported approximately 48 Mmt of coking coal. About 28 Mmt of that was from the United States and 3 Mmt was from

Figure 4.1

CASE II: European Electric Utility Market

Range of Delivered Cost Components,
0 Percent DCFROR



Poland. Canada, Germany, and Australia were also major players in the European coking coal market. The United Kingdom (the market chosen for this case) imported about 8 Mmt of coking coal in 1989.

It is difficult to make precise competitive comparisons of the European coal import market by supplier countries because of the wide range of coal qualities imported. This is particularly true in comparing U.S. metallurgical coals with coals from other countries, including Poland.

Most U.S. metallurgical coals exported have a combination of desirable coking characteristics not readily found in coals from any other supplying country. The superior quality characteristics of U.S. coal are their high free-swelling indices and high fluidities. Polish coals range across a broad spectrum of quality; low-to-high free-swelling indices and low-to-high fluidities. However, the relative amount of high-quality coking coal combining both a high free-swelling index and fluidity is probably very limited. This competitive analysis between Polish and U.S. metallurgical coals is not adjusted for the special qualities of U.S. coals. Adjustments in the values of metallurgical coals based on their quality characteristics are specific to the special needs of each steel mill or industrial plant.

There are four Polish and four U.S. mines used for comparison in Case III. All of the Polish mines are longwall mines examined previously in Case I. The U.S. mines include two longwall mines examined in Case I, one each in Virginia and Alabama, and two additional mines for market comparison purposes: one deep longwall mine in West Virginia and one deep longwall mine in Alabama.

As in the previous market case, all of the Polish mines rail their coal to ports on the Baltic Sea. Swinoujscie and Gdansk North Port are used again because of their ability to load Panamax vessels or larger. Both Panamax and Capesize vessels are used for shipment to the United Kingdom receiving port. The ocean shipping distances from Swinoujscie and Gdansk to the United Kingdom receiving port are approximately 2,360 and 2,630 km, respectively.

The Virginia and West Virginia mines rail their coal approximately 690 km and 800 km, respectively to the Hampton Roads area ports for shipment aboard Panamax or Capesize vessels to the United Kingdom receiving port. The shipping distance from the Hampton Roads area to the United Kingdom receiving port is approximately 5,920 km.

Both of the Alabama mines use river transportation to the Port of Mobile. One mine trucks its coal to the river loadout, the

other uses rail transport. An alternative method of railing the coal to Mobile for shipment is not considered in this analysis. The coal is barged approximately 650 km, to the Port of Mobile, where it is loaded into Panamax vessels for the 8,250 km ocean voyage to the United Kingdom receiving port.

Delivered Cost Comparisons and Findings -- Table 4.2 summarizes the cost comparisons, and Figure 4.2 illustrates the cost ranges. The Polish coal mines have a delivered cost ranging from $39.69 to $55.34/mt while the U.S. mines' delivered costs range from $50.06 to $66.64/mt. The Polish mines in this case have a minimum delivered cost advantage of more than $10/mt.

Total mine-mouth costs for the U.S. and Polish mines overlap considerably and show a striking similarity in the mine-mouth cost. A comparison of the production costs and the taxes and penalties, however, shows substantial structural differences. Although Poland enjoys lower production costs, probably because of its lower labor and materials costs, the Polish industry has consistently higher taxes and penalties levied on it in comparison to the U.S. industry. As with the previous case, the 20 percent export tax has a significant effect on the level of taxes and penalties.

TABLE 4.2
Case III: European Metallurgical Coal Market
Delivered Cost Summary
(1989 U.S. dollars per metric ton salable coal)

Cost Category at Zero Percent DCFROR	U.S. Range	Polish Range
Total mine-mouth cost	27.20 - 39.96	28.42 - 42.55
Production*	23.75 - 36.66	15.87 - 27.44
Land, taxes, and penalties	2.05 - 6.92	12.55 - 15.11
Transportation	19.46 - 27.31	11.27 - 12.78
Trucking (from mine)	0.00 - 1.50	0.00 - 0.00
Rail rate	0.00 - 18.14	5.70 - 6.22
Barge rate	0.00 - 5.39	0.00 - 0.00
Port charges	0.00 - 3.14	1.73 - 1.81
Ocean freight	8.25 - 10.00	3.75 - 4.75
Total Delivered Cost	50.06 - 66.64	39.69 - 55.34

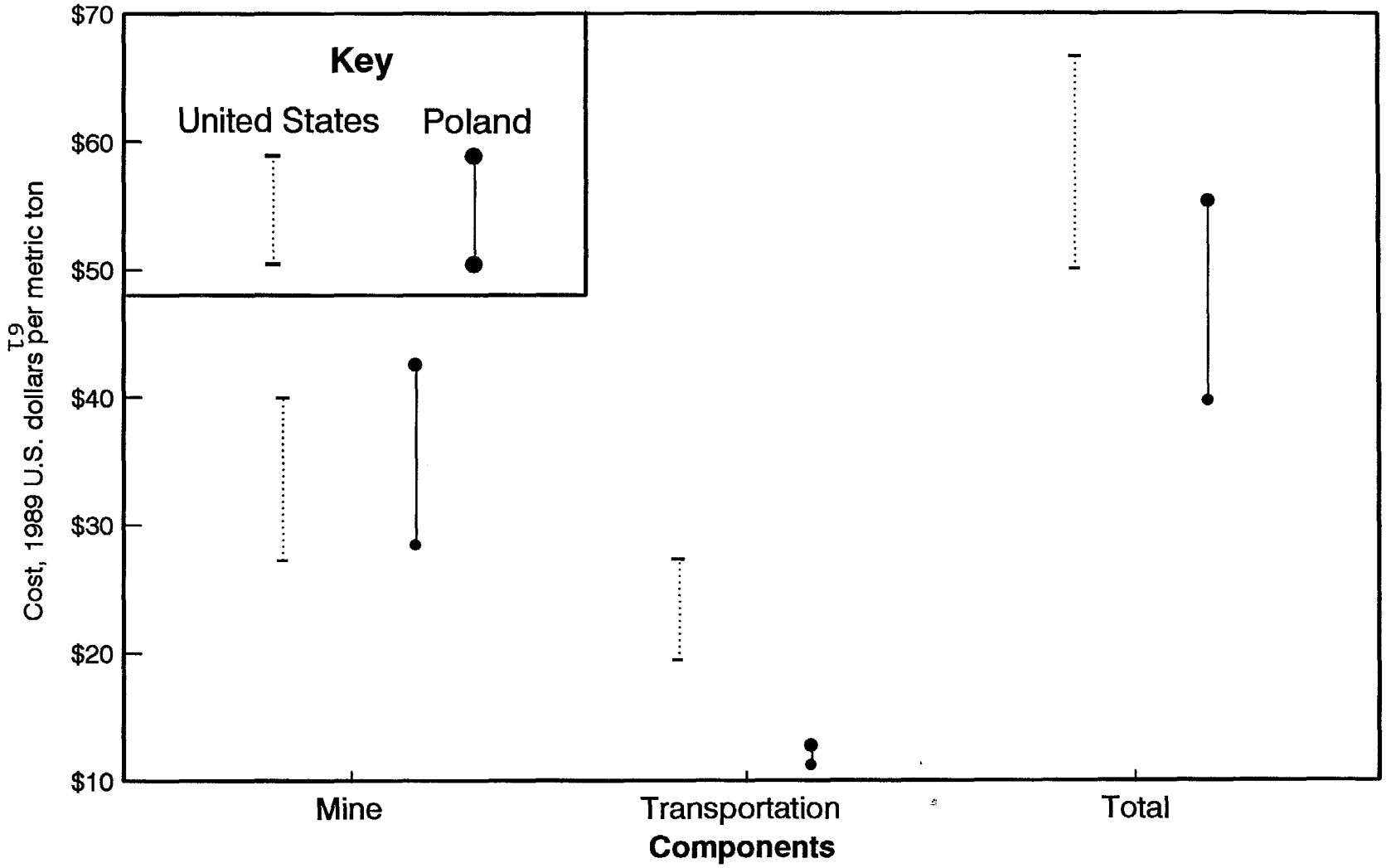
* Production cost includes all capital and operating costs for both the mine and preparation plant.

Note: Totals may not add because they represent the costs at an individual mine. Cost components within a column may be from several different mines to illustrate the minimum or maximum value for each respective cost component among the mines. Exchange rate used is Zl 1,446 = US $1.00

Figure 4.2

CASE III: European Metallurgical Coal Market

Range of Delivered Cost Components,
0 Percent DCFROR



Transportation costs for U.S. mines are consistently higher than for the Polish mines. For the U.S. mines that rail coal to the port, both inland transportation and ocean shipping costs are higher than their Polish counterparts. For the Alabama mines, the inland transportation costs are lower than the mines in central Appalachia, but the ocean freight is higher because of the greater distance to the consumer. The ocean freight for all U.S. coal exports to Europe is consistently higher than that of Polish shipments because of the longer distance.

Summary of Findings

The basic findings from the two market competitiveness case studies can be summarized as follows:

- Total Polish and U.S. mine-mouth costs are generally comparable for both the steam and metallurgical coal markets. However, a breakdown of the costs indicate significant structural differences between the two export industries. Polish mines have generally lower production costs and higher tax and penalty costs than their U.S. counterparts.

- In both the European steam and metallurgical coal markets, Polish coals generally have a delivered cost advantage over U.S. coal. Both the generally higher inland freight in the United States and the longer ocean shipping distances to European customers result in higher transport costs for U.S. exports.

The findings in this study are consistent with the generally accepted view in the international coal trade regarding the competitive advantages and disadvantages of the U.S. and Polish coal industries.

In the United States, the rail haulage distance to port is significantly longer, about 1.5 times longer than in Poland. The U.S. rail transport costs for export coal are typically 2.5 times higher than rail transport costs in Poland. Shipping by barge to gulf coast export terminals is generally cheaper than rail shipping, but many U.S. mines do not have efficient access to river terminals.

Geographic location with respect to an overseas consumer is an important competitive cost factor. U.S. mines exporting out of the gulf or east coasts have a considerable ocean freight cost disadvantage to the European market compared with Polish mines. Ocean transit distances to the European customers are generally 2 to 3.5 times greater for U.S. exporters than for the Polish coal exporters.

As a final note, the findings from these cost competitive market case studies should be considered time sensitive. Relative cost competitiveness can change quickly for a variety of reasons. The major cost factors subject to change are currency exchange rates (relative to competing coal exporting countries), ocean freight rates, and Government policies. Unlike countries in previous studies, Poland is experiencing rampant inflation, a rapidly changing labor environment, and an extraordinary level of uncertainty regarding Government policies toward taxation, resource development, royalties, and the privatization of state enterprises. All of these factors increase the risk to private and foreign investors and discourage capital investment at a time when the Polish coal industry and the Government can least afford it.

GLOSSARY

Alpine Miner - A specialized tunneling machine consisting of one or more pivoted cutter booms with rotary cutterheads and a loading and conveying device. The cutterheads are equipped with replaceable tungsten-carbide tipped picks or bits. In operation the boom or booms range across the face ripping the rock, which drops to the floor where it is gathered and loaded to a transfer conveyor for discharge to a haulage system. Also known as a roadheader, due to use in driving entries or roads.

Ash Content - The amount of inorganic residue remaining after the complete combustion of coal, usually defined as a percentage by weight. For test procedure, see American Society for Testing and Materials (ASTM) specification D3174.

Bituminous Coal - A coal that is high in carbonaceous matter, having a volatility greater than that of anthracite and a calorific value greater than that of subbituminous coal and lignite. Refer to ASTM Specification D388-66 for bituminous coal.

Black Lung Tax - The tax imposed by the U.S. Federal Government to sustain the Black Lung Fund, which is used to compensate coal miners (or their estates) afflicted with pneumoconiosis (which includes black lung) or other respiratory ailments contracted from prolonged exposure to dust-laden atmospheres.

British Thermal Unit (Btu) - A standard unit for measuring the quantity of heat energy equal to the quantity of heat required to raise the temperature of 1 pound of water by 1 degree Fahrenheit.

Capesize - Term used to describe oceangoing vessels with dimension too large for traversing the Panama Canal and therefore must travel routes around Africa or South America. Sizes for these capesize vessels can range from 125,000 to 250,000 deadweight tons (dwt).

Cash-flow - Reported net income of a corporation plus amounts charged off for depreciation, depletion, amortization, and extraordinary charges to reserves.

C.i.f. Value - Cost, insurance, and freight value. The value of a product or commodity on shipboard at the receiving terminal.

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Coal Chain Infrastructure - The corporate and physical entities involved with the production, distribution, and sale of coal. Includes, but is not limited to, coal producers, railroads, barge lines, export terminals, testing laboratories, and their physical assets.

Coal Deposit - A natural accumulation of coal in a specified area. Smaller in scope than a coalfield or coal region.

Coal Rank - The position of a coal relative to other coals in the ranking series, which indicates the degree to which the original coal-forming material has been changed by metamorphism through successive states from peat to anthracite (ASTM D308).

Coal Region - Large geographic area underlain by coals of a similar type or age.

Coal Seam - Coal existing in a single layer and of like age and rank.

Coalfield - A natural area of land containing coal or coals of similar geologic age. Coalfields are smaller in areal extent than coal regions.

Coke - Carbonized coal created by heating bituminous metallurgical coal in the absence of air, which drives off the distillable volatiles and leaves a porous solid residue consisting mainly of carbon.

Coking Coal - See metallurgical coal.

Continuous Miner - A machine used in underground mining that mechanically breaks the coal and loads it onto a conveyor or vehicle for transport to a central location within a mine. Used mainly in room and pillar mines and for development of entries in longwall mines.

Contour Mining - Surface mining method prevailing in mountainous and hilly terrain. The overburden is removed above the coal outcrop in one or more benches until the economic depth limitation is reached. The benches follow the shape of the hillside.

DCFROR - Discounted cash flow rate of return or the rate of return that makes the present value of cash-flows from an investment equal to the present worth of all after-tax investments.

Deadweight Tons (dwt) - The capacity in long tons of cargo, passengers, fuel, stores, etc., of a vessel: the difference between the loaded and light displacement tonnage of the vessel. A long ton is equal to 2,240 pounds avoirdupois.

Depletion - The subtraction of both the tonnage produced and the tonnage lost to mining from the demonstrated reserve base. Also, a tax-related term for the deduction taken from the cash-flow, prior to taxes, to provide for future investment in reserves.

Depth of Cover - Thickness of overburden covering the coal seam.

Dip - The angle at which a bed, stratum, or vein is inclined from the horizontal.

Dragline - An overburden removal machine used in stripping coal seams because of its great reach and its ability to cast spoil farther from the pit. Used for the recovery of moderate depth coal seams.

Engineering Costs - Estimates of component costs derived by applying operational experience (e.g., necessary labor force) and input prices (e.g., wage rates) to all individual physical inputs to a production process.

Entry - Opening in the coal seam that constitutes the main access, or roadway, into the mine or mine section. The number of entries is determined by the requirements of ventilation, haulage, escapeways, and mine services such as power, water, and drainage.

Fluidity - The physical property of a substance that enables it to flow. It is a measure of the rate at which a substance is deformed plastically by a shearing stress as contrasted with viscosity. When in reference to coal, it typically refers to maximum fluidity in dial divisions per minute (ddpm) as measured by test methods using the Gieseler plastometer (ASTM D2639-90).

F.o.b. Value - Free on board value. The value or cost of a product or commodity loaded on board a carrier at the point of shipment, exclusive of any insurance or freight charges.

Free-swelling Index - An indication of the caking characteristec of the coal when burned as a fuel (ASTM D720-83), expressed as a number between 1 and 9, with 9 being the highest or most strongly caking. Also known as the "coke button" number, it is an imperfect but commonly used indicator of the some of the coking and swelling properties of coals.

Hard Coal - All coal higher rank than lignite. European nomenclature typically denoting coal of subbituminous, bituminous, or anthracite rank, as opposed to lignite or "brown" coal.

Infrastructure - The basic underlying framework or features of something. As used, the necessary transportation, communication, and support facilities for modern human societies. May include roads, railroads, airports, electrical supply, telephone or other communications networks, water and sewage facilities, housing, and medical, teaching, and recreational facilities.

Lignite - A brownish-black coal of lower rank with high inherent moisture and volatile matter, used almost exclusively for electric power generation. Conforms to ASTM Specification D388-66 for lignite.

Longwall Mining - An underground method for mining coal, usually in deep seams. Mining proceeds continuously on a linear, advancing or retreating face, which can be up to 200 meters or more in width. In longwall mining, the roof is supported by hydraulic supports; a revolving shearer or plow cuts and breaks the coal, and the coal is removed from the mining face by a chain conveyor.

Measured Reserves - Coal for which estimates for the quantity have been computed, within a margin of error of less than 20 percent, from sample analyses and measurements from closely spaced and geologically well-known sample sites.

Metallurgical Coal - Coal used for making coke for steel making.

Mine-Mouth Cost - Total capital, operating, and other direct and indirect costs of coal delivered to the point of shipment from a mine. Mine-mouth cost is equivalent to an f.o.b. mine cost.

MINSIM/09 - (MINeSIMulator) A ninth-generation computer program, which simulates the cash-flows of a mining operation during its productive life using specific operating characteristics, costs, and revenues, developed by the U.S. Bureau of Mines to evaluate the economic feasibility of mining operations.

Moisture Content - A measurement of the amount of water present in coal at the time of sampling and is applicable to coals as mined, processed, shipped, or used in normal commercial pursuits (ASTM D3302).

Mountain-Top-Removal - Surface mining method that involves leveling a peak during the process of removing alternate seams of rock and coal. It often involves filling a valley contiguous to the mountain (mountain-top-removal and valley fill).

Net-back - The value of a ton of coal at any desired point, usually calculated by taking the revenue received at the point of sale, and then subtracting all costs (e.g., port and transport costs) incurred between the desired point and the point of sale.

Open Pit - Surface mining method that involves removal of topsoil and overburden to expose and mine the coal. Seams may be dipping or relatively level as in bench mining. Most often used to refer to operations having thick coal seams relative to the amount of overburden.

Panamax - Term used to describe oceangoing ships with dimensions that enable them to traverse the Panama Canal with maximum cargo loading possible. Ship dimensions are limited to 275 meters length, 32.5 meters beam, and 11.3 meters draft. Typical maximum cargos are 65,000 dwt with full dwt cargo and 80,000 dwt for ships in ballast.

Plow - A cutter loader for a longwall machine with knives, blades, or picks, which is pulled along the longwall face by a chain. The broken coal is loaded onto an armored face conveyor for transport away from the working area.

Productivity - A measure of output per unit of time; in the case of the mining industry, this is usually measured in terms of tons per worker-shift, or the tonnage produced by the average individual over one working shift.

Quality, Grade, or Rank - Refers to individual measurements such as heat value; fixed carbon; moisture; ash; sulfur; phosphorus; major, minor, and trace elements; coking properties; petrologic properties; and particular organic constituents. The individual quality elements may be aggregated in various ways to classify coal for such special purposes as metallurgical, gas, petrochemical, and blending usages.

Raw Coal (Run-of-Mine Coal) - Coal extracted from the seam and not processed, washed, crushed, or sized.

Reclamation Tax - Tax imposed by the U.S. Federal Government to ensure reclamation of abandoned mined lands.

Recovery Factor - The percentage of total tons of coal estimated to be recoverable from a given area divided by the total tonnage estimated to be in the demonstrated reserve base. For the purpose of calculating depletion factors only, the estimated recovery factors for the demonstrated reserve base generally are 50 percent for underground mining methods and 80 percent for surface mining methods. More precise recovery factors can be computed by determining the total coal in place and the total recoverable in any specific locale.

Reserve - That portion of the resource base that is estimated to be economically recoverable with the technology and prices prevailing at the time of determination. The reserve is derived by applying a recovery factor to that component of the identified coal resource designated as the demonstrated reserve base.

Roadheader - See Alpine Miner.

Salable Coal - Coal sold to a customer. Salable coal is usually washed or processed to remove impurities, and/or crushed and sized to meet customer specifications.

Seam Inclination - The degree of slope of a coal bed from the horizontal plane.

Seam Thickness - The distance from top to bottom of a coal seam; critical to determining reserves.

Shearer - A cutting machine which shears coal or other easily broken mineral from the face of a seam or other suitable formation and delivers the broken material continuously to a conveying system.

Steam Coal - Coal used by electric power utilities and industry to generate steam and electricity.

Strippable - Coal resources or reserves that can be mined using surface mining methods.

Stripping Ratio - A measure of the overburden that must be removed to mine a quantity of coal; in English units this is usually expressed as the ratio of bank, or in situ, cubic yards of overburden moved per ton of coal recovered.

Subbituminous Coal - A dull black solid fossil fuel ranking between lignite and bituminous coal. In the United States it is mined chiefly in Montana and Wyoming.

Sulfur Content - The percentage of total sulfur, on a weight basis, that is contained in coal (ASTM D3177-75).

Thermal Coal - See steam coal.

Volatile Matter - A measure of the gases that are released from coal on heating to a temperature of around 250° Celsius in proximate analyses, but excluding moisture vapor (ASTM D3175-77).

APPENDIX A

POLISH TAXES, PENALTIES, AND ROYALTIES

Taxes

Introduction

This appendix presents all of the taxes pertinent to the Polish coal mining industry. General taxes as well as taxes specific to the coal industry are presented. This includes payroll taxes and social funds established by the Polish authorities that are similar in function to the U.S. Social Security tax or negotiated contract fringe benefits.

The Polish tax system which was in place during 1989 has recently undergone significant changes. Some of the changes, such as the rules on depreciation, were incorporated into this study for the sake of simplifying the analysis. Otherwise, the study uses the 1989 tax codes for the analysis.

Income Taxes -- The corporate income tax in Poland is 40 percent. All corporations, including state-owned corporations, are subject to the tax. Table A.1 summarizes the method used for calculating the Polish income tax in this study. Table A.2 summarizes the Polish Central and local taxes and other charges levied on coal producers.

TABLE A.1
Sample Income Tax and Cashflow Calculation

(A)	Coal revenue	$50,000,000
(B)	Other revenue	3,000,000
	Gross Revenues	$53,000,000
(C)	Less: Expenses	(45,000,000)
	Taxable Income Before Depreciation Allowance	8,000,000
(D)	Less: Depreciation	(5,000,000)
	Taxable Income	3,000,000
(E)	Less: Income tax (@40%)	(1,200,000)
	After Tax Income	1,800,000
(F)	Add: Depreciation	5,000,000
	Cashflow	$6,800,000

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Explanation of Table A.1:

(A), (B) Revenues from mining are the only revenues considered in this study, although the mines typically own and operate other businesses: construction and engineering consulting, and vacation resorts and spas for the benefit of their workers.

(C) Only expenses incurred to produce coal are considered in this study, although any normal expenses from any of the Polish mines' businesses are deductible from revenues. These include, for example, expenditures for labor, supplies, local taxes, technical levies, insurance, and payroll taxes. Some specific Government imposed costs included in this study as labor costs (and essentially equivalent to fringe or contract benefits and Social Security tax in the United States) are:

(1) Wage tax of 20 percent of gross worker and supervisory wages, paid entirely by the mine to the Central Government.

There is also an excess wage tax (popiwek), enacted in 1990, which must be paid by companies (in which 50 percent or more of the shares belong to the Central Government) when wage levels exceed certain norms. This tax was not used, and had no bearing on the analysis in this study, but could have a bearing now and in later years because the norms for coal mines, established in 1990, hinge on a wage pot or total wage cap for the mine. The Central Government determines the cap and is using it both to hold down wage increases and encourage the mines to reduce its personnel, because that is the only way the mine can meet demands for increased wages without incurring the excess wage tax. Unions are likely to petition the Government to reduce the tax.

(2) An insurance tax of 43 percent of all wages for sick leaves, pensions, and hospitalization, is mandated by the Central Government and paid to the state insurance company. Another 2 percent of wages is collected for unemployment.

(3) A housing fund levy determined annually by the Central Government pays for miners' apartments; it is essentially a building fund. The account is kept and disbursed by the mine management. The levy in 1989 was equal to the average annual wage for all Polish workers times the number of people employed at the mine, multiplied by a factor of 0.125 percent. For 1989, an additional housing fund of 0.08 percent of the Saturday and Sunday wages of mine and preparation plant workers was in effect. This additional housing fund was deducted from the wages tax payable.

(4) Social fund levies go to pay for vacation resort maintenance, lower (subsidized) rents, gardens, and daycare

services, all of which are provided by the mine. The fund, like the housing fund, is mandated by the Central Government, but kept in the mines' accounts and spent at the discretion of mine management. The levy in 1989 was equal to the average annual wage for Polish workers times the number of people employed at the mine, multiplied by a factor of 0.25 percent. Mines have a special privilege (all mines take advantage of it) to make bigger social funds for underground miners. This additional social fund is the average annual wage for Polish workers, times 0.15 percent, times the number of workers underground.

Polish taxes other than income tax are also considered deductible for the purposes of calculating the income tax in this study. A description of the individual taxes and charges other than income tax are listed following the explanation of the sample calculation.

(D) Depreciation in Poland for mine plant and equipment is straight line depreciation according to an established schedule for equipment types and plant. Accelerated depreciation was only introduced in 1992, and is not used in this analysis. In this study, Polish shearers and roadheaders are depreciated over 4 years, longwall shields over 5 years, and the hydraulic and electrical components over 10 years. Other items such as buildings and plant have extended depreciation schedules (from 20 to 40 years) depending on the expected life of the asset. Annual rates of depreciation (termed amortization by the Poles), expressed as a percent of the initial purchase price plus revaluation, are as follows:

Mining equipment (excluding mechanized roof supports) - 25%
Mechanized roof supports - 20%
Coal preparation equipment - 8.5 to 10.0%
Other mineral processing equipment - 12.5 to 14.0%
Drilling equipment - 17.0 to 20.0%
Mine hoist - 4.0 to 5.0%
Conveyors - 17.0 to 20.0%
Push-plate conveyors - 50.0%
Mining cars - 12.5 to 14.0%
Buildings - 2.5%
Construction (shafts, etc.) - 4.0%, for mines, construction could be increased up to 2 times.

Because of the rampant inflation experienced in Poland over the past few years, the Central Government allowed the State Coal Agency to revalue the mine assets to take into account inflation. The intent of the revaluation was to allow the enterprises to replace adequate amounts of capital through depreciation to cover replacement costs, now inflated, for new equipment. Revaluation has the net effect of boosting the current book value of all the

assets, particularly the older plant. The official, revalued assets were used in the analysis.

Prior to January 1990, depreciation was used to buy new fixed assets, with the mine keeping part of the declared depreciation and the State Coal Agency keeping the other part and disbursing funds to the mines for the purchase of new assets. The mine would submit proposals for purchases to the State Coal Agency, which would then either accept the proposal and remit funds for the purchase, or deny it. Purchases could only be made from these two accounts; use of other funds was prohibited. Since January 1990, the individual mines keep their declared depreciation for use as they see fit.

A significant difference between Polish and U.S. accounting systems is that, in 1989, Polish accounting allowed for the continued declaration of depreciation past the scheduled life of the equipment, as long as the equipment was still serviceable. This implies that total depreciation taken on an individual piece of equipment could exceed its initial purchase plus revaluation, or book value. In 1990, the tax laws were changed to prohibit this practice. Because of the change, and for the sake of simplifying the analysis in this study, accumulated depreciation could not exceed the official revaluation of old equipment or the purchase price of new equipment (e.g., we assumed that the useful life of the equipment was directly reflected by the depreciation schedules).

(E) The income tax for all corporate income in Poland, including state-owned corporations, is 40 percent.

(F) Depreciation is added back to the after-tax income to arrive at the net cash-flow.

Other taxes and Government charges of interest include:

State Income Tax -- There is no state (i.e., vovoidship) income tax on the coal mines.

Depletion Allowance and Severance Tax -- There is no depletion allowance or severance tax.

Property Taxes -- There were no local property taxes on the mining enterprises in 1989, and none were included in the analysis; however, these taxes were part of the 1990 tax reform. The property taxes are collected by the local province, or vovoidship. The relevant 1990 property tax rates are 0.05 percent of the gross value for houses and apartments, Zl 8,000 per square meter of industrial (workshops, administrative buildings, preparation plants) floorspace, 2 percent of the gross value of the mine plant (shafts, hoists, etc), and Zl 220 per square meter of land. Gross value is defined as the purchase

price plus the revaluation (which accounts for inflation) less depreciation.

Reclamation Fund -- This levy is for recovering the grounds to the previous appearance before mining and reclaiming and managing the waste heaps. This fund is levied on a per ton basis. It averaged approximately Zl 47/mt of salable coal in 1989, although it had risen to approximately Zl 117/mt by December 1989.

Special Fund -- This levy by the local Government went chiefly to address the destruction of forests caused by the burning of coal. The rules for the mines' contributions to these funds are set and often changed by the local Governments. As this fund was not significant to our cost analysis (less than $0.01/mt of salable coal), it was not used.

Geological Fund -- The fund is administered by the Ministry of Environmental Protection and Natural Resources, and is usually charged on a tonnage basis. The levy averaged approximately Zl 84/mt of salable coal for 1989, but had risen to Zl 189/mt by December 1989. Exploration service charges are dependent on the amount the mine used the state geologist, often the mine will do its own exploration work.

Technical Progress (Science and Technology) Fund -- The economic and technical progress levy goes to the Central Fund of Development and Science and Technology, a Central Government institute, and is charged as a percentage of all revenue, including coal and electricity sales, consulting income and other operations. The levy increased significantly in 1989 (from 0.17 percent) to an average of approximately 0.66 percent for all of 1989. This fund was replaced in 1990 by the Science and Technology Fund and the rate increased to 1.2 percent.

Coal Board -- This levy went to the Ministry of Industry for the maintenance of the Coal Board, an industry association that preceded the State Hard Coal Agency.

Property Insurance -- In 1989, mines were mandated to carry property insurance with the state insurance company. In 1990, this insurance was carried by the mines on the basis of contracts rather than mandated payments. The assessments are based on the value of the property, including revaluation and less depreciation.

Target Fund -- This target fund was in place in 1989, but was discontinued in 1990; it was used as a merit pay system for Polish workers. This particular fund was not of consequence to any of the mines examined in this study (less than $0.01/mt in 1989) and was therefore not included as a line item in the tax and penalty section of the cost analysis.

Subsidence Charges -- Damage assessments are negotiated with a local review committee after a complaint has been filed by an individual. Once an assessment is made, the committee determines which mine is responsible and levies the assessment on the operation. There appears to be some flexibility in the process, as some mines in the study indicated they had an option of doing the repair work with their own crews, paying the assessment, or some combination thereof. Since Polish law requires the mines to seek 100 percent extraction of the significant coal seams (coking coal seams 0.5 meter or greater, and steam coal seams 0.8 meter or greater), subsidence of the surface is virtually a foregone conclusion unless stowing is practiced. Even with stowing, up to 20 percent of the height of the coal seam is evident as subsidence. While stowing is practiced at many mines, virtually all of the mines incur subsidence damage assessments. For those mines operating in heavily populated areas these assessments can be substantial. In rural areas, the subsidence damage typically involves damages caused by flooding when surface waters change direction.

Environmental Protection Charges -- Environmental charges, levied by the Ministry of Environmental Protection and Natural Resources, are based on the saline water and stack gas emissions of the mines and their mine-mouth powerplants.

The enabling legislation for environmental regulations is an Act of Parliament, January 31, 1980 (No. 3/80). The legislation itself is fairly general. Executive orders and specific regulations enacted since then form the practical basis for the operating practices of the mines and the fines imposed for noncompliance.

Fines are levied for noncompliance with environmental regulations on discharge of mine waters, specifically saline water, into surface waters. The fines vary according to both the quantity and salinity of the discharge, and in some cases can be quite substantial. A distinction is apparently made between normal use of the water resource, which carries its own specific fees, and excessive saline water discharge into surface waters. Most of the problem is centered in Upper Silesia (Gornoslaski Coal District). Mine water is classified according to the total mineralization in chloride and sulfate ions per 1 liter of water:[1]

Category I: Potable water - up to 600 mg of $Cl^-+SO_4^{2-}/L$
Category II: Industrial water - 600 to 1,800 mg of $Cl^-+SO_4^{2-}/L$
Category III: Salty water - 1,800 - 42,000 mg of $Cl^-+SO_4^{2-}/L$

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[1]Polish Coal, General Information, The State Hard Coal Agency Joint Company, Katowice, Poland, August 1990.

Category IV: Salt water - above 42,000 mg of $Cl^- + SO_4^{2-}$/L

The penalties for saline water discharge are Zl 95/kg for each kg of chlorides and sulfates discharged to surface waters, and Zl 12/kg for each kg of chlorides and sulfates discharged to surface waters through storage reservoirs. Typically, the mines usually pay the normal use fees which make up the bulk of the fines,, but often do not pay the excess discharge assessments, principally because they are contested assessments. For the purposes of this analysis, the amount listed as being paid in the mines' cost worksheets was used.

Miscellaneous Charges -- Listed in the mines' cost worksheets as "other nonmaterial charges" were charges reported to U.S. Bureau of Mines personnel as being the cost of licenses, patent fees, technical information transfers, and advertising of lower quality product coal in order to make sales. For some mines, this was a significant cost item.

Turnover (Export) Tax -- In 1989, the turnover, or export tax, for coal exports was 20 percent of the f.o.b. sales price. This tax was changed several times in 1990: in January, it was increased to 80 percent, from April to August, it was 50 percent, and in August it was lowered to 20 percent. In September 1990, the export tax was applied only to hard coking coal and to graded, or screened, steam coals. Beginning April 16, 1991, the tax was applied only to graded steam coals. In July 1992, the export tax for graded steam coals was suspended until March 31, 1993.[2] Legislation currently under consideration would establish a value added tax (VAT); it is uncertain whether it would apply to coal or not. For this analysis, an export tax of 20 percent of the f.o.b. port of exit price of the salable coal was used in the computation of delivered price to export customers.

Nonresidents Withholding Tax -- The Polish-U.S. bilateral tax treaty in 1974 established a nonresident withholding tax. The current nonresident withholding tax on dividends for U.S. corporations with foreign holdings (investments in Polish companies of at least 10 percent of the Polish company's equity) is 5 percent; in all other cases (where the U.S. firm's investment in the Polish firm is less than 10 percent of equity) it is 15 percent.[3] While the nonresident withholding tax is mentioned here, it played no part in the analysis contained in

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[2]October 13, 1992 telefax communication from Weglokoks.

[3]The Guide for Foreign Investors in the Cracow Region, The Governor's Office in Cracow, Economic Development and Communication Department, Cracow, Poland, 1992.

this report, because the mines are wholly owned at this time by the Polish Government.

Marketing Charges -- In 1989, the only legal avenue for coal mines to export coal mines was to sell their coal to the Central Coal Bureau, who sold it to Weglokoks, who then negotiated the export sale with the foreign buyer and arranged transport. The cost of this service apparently varied somewhat from mine to mine, but was most often mentioned as being 2 percent of the sales price. In 1990, this arrangement was altered somewhat in that mines could export on their own account, but were prohibited from undercutting the prices negotiated by Weglokoks. Although this pricing requirement was lifted sometime during 1991, a majority of the export mines have signed 8-10 year export marketing contracts with Weglokoks. For this report, an export marketing charge of 2 percent of the mine-mouth sales price was assumed for calculating the delivered price of export coal.

Dividends -- Dividends must be the first item paid out of after-tax income. All mines must pay dividends to the Central Government. These dividends represent a return to the state for the use of state assets. Dividends in 1989 were 11 percent of the value of a mine's assets (original purchase price, plus revaluation, less depreciation), in 1990 this rate increased to 35 percent of the asset value. If the mine pays for assets with their own funds, no dividend is paid to the Central Government on those assets.

Royalties

There are currently no royalties for mining state-owned coal reserves. This situation is expected to change as there have been a number of proposed legislative changes that would in effect extract a license fee, or concession, for the right to mine a property.

TABLE A.2
Polish Central and Local Taxes
and Other Charges on Mining Activities*

	Polish Central	Katowice Vovoidship
Income Tax	40%	None
Wage Tax	20% of gross wages	None
Insurance Tax	43% of gross wages	None
Work Fund (Unemployment, etc.)	2% of gross wages	None
Housing Tax	Formula, 0.125% of average wage of all Polish workers, times number of workers at mine, plus 0.08% of weekend wages of all mine workers	None
Geological Fund	Varies, usually charged on tonnage basis; Zl 84.34/mt average for 1989, Zl 189.38/mt December 1989; Exploration services charged differently	None
Science and Technology Fund	Approx. 0.66% of revenue for 1989; 1.2% in 1990	None
Reclamation Fund	46.80 Zl/ton avg. for 1989 117.08 Zl/ton December 1989	None
Coal Board	Determined by state, average 0.1 to 0.2% for 1989	None
Property Insurance	Insurance with state insurance agency mandatory in 1989, moved to contract basis in 1990	None
Subsidence Assessments	None	Set by review committee, and negotiated with complainant
Environmental Protection Assessments	Levied by Minister of Environmental Protection and Natural Resources based on air and water emissions, and published standards	None
Miscellaneous Charges	Varies by mine: consists of licenses, patent fees, charges for technology transfer	None
Turnover Tax (Export tax)	20% of f.o.b. sales price in 1989, increased to 80% 1/90, decreased to 50% from 4/90 - 8/90, lowered to 20% 8/90	None
Property Taxes	Dividends must be paid if mine is profitable; for use of state assets	Road and local property taxes enacted in 1990
Nonresidents Withholding Tax	5 or 15%, dependent on amount of foreign holdings, set by bilateral treaty	None

* Taxes, assessments, penalties, and other Government charges as of 1989.

APPENDIX B

U.S. Federal AND STATE TAXES AND BONDING REQUIREMENTS FOR MINING OPERATIONS

Table B.1 shows the U.S. Federal tax, State taxes, fees, charges, and bonding requirements levied on coal producers used in this study. Details of the requirements used in this study, and in effect during 1989, are contained in the following paragraphs.

Most of the charges described were accounted for in the study, either directly as taxes, or included in the cost of capital, or equipment and supplies. One important exception was the reclamation bonding requirement; it was not included in the analysis because these funds are returned to the company after successful completion of reclamation activities.

U.S. Federal Tax Regime

The U.S. Federal corporate income tax is a graduated rate with a maximum of 34 percent on taxable income over $335,000. Taxable income between $100,000 and $335,000 is taxed at 34 percent plus an additional 5 percent. The graduated amounts are as follows:

(1) 15 percent of the taxable income as does not exceed $50,000;

(2) 25 percent of the taxable income as exceeds $50,000 but does not exceed $75,000;

(3) 34 percent of the taxable income as exceeds $75,000 but does not exceed $100,000;

(4) 39 percent (34 percent plus an additional 5 percent) of taxable income as exceeds $100,000 but does not exceed $335,000;

(5) 34 percent of the taxable income as exceeds $335,000.

Corporations may be subject to the alternative minimum tax in such instances when the alternative minimum tax payable exceeds Federal income tax payable. The alternative minimum tax rate is 20 percent of the alternative minimum taxable income, calculated by adjusting Federal taxable income and adding preference items.

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TABLE B.1
U.S. Federal and State Taxes
and Other Charges on Mining Activities*

	U.S. Federal	Alabama
Income Tax	39% (1987) 34% (1988 and later)	5%
Alternative Minimum Income Tax	20% of alternative minimum taxable income; payable when Federal income tax payable is exceeded	None
Percentage Depletion Allowance	Deduction of 8% (effective rate) of gross income allowed in calculation of alternative minimum income; not to exceed 50% of taxable income from property	None
Royalty	12.5% surface, 8% underground	Varies; 12.5 to 18.75% for State lands, set by bid, or $3.30/mt, whichever is greater; private lands negotiated
Severance Tax/ Business Occupation	None	$0.15/mt excise, $0.22/mt severance
Sales/Use Tax	None	1.5% equipment State Counties: 0.25% Jefferson 2% general Tuscaloosa 1% vehicles Tuscaloosa
Property Taxes	None	65 mills State Counties: 421 mills Jefferson 265 mills Tuscaloosa 250 mills Fayette 235 mills Walker
Coal Fee Rents/ Lease Charges	Bonus bid, nonrecoverable	None
Nonresidents Withholding Tax	30%, exempted for trade or business within U.S.	None
License Fees	None	None
Work Requirements, Fees	Due diligence for Federal leases, no mandatory fees	None
Black Lung Tax	$0.61/mt surface, $1.21/mt underground, or 4.4% f.o.b. mine price, whichever is less lignite exempt	None
Abandoned Mine Lands Fee	$0.39/mt surface, $0.17/mt underground, or 10% f.o.b. mine price, whichever is less, lignite $0.11/mt or 2% of f.o.b. price, whichever is less	None
Reclamation Bonding and Fees	None, State primacy	Minimum $10,000; total set by State, recoverable

TABLE B.1
U.S. Federal and State Taxes
and Other Charges on Mining Activities-continued

	Virginia	West Virginia
Income Tax	6%	9.675%, decreasing to 9% by July 1, 1992
Royalty	None, no State land currently leased for coal operations	No standard, no active State leases
Severance Tax/ Business Occupation	None	3.85% mine-mouth value +0.88% sales value
Sales/Use Tax	3% on motor vehicles, 3.5% goods and services, None on domestic coal sales	6% excise tax on personal property
Property Taxes**	None State Counties: 73 mills Lee 59 - 195 mills Buchanan 53 - 219 mills Dickenson 39 - 115 mills Wise	None State Counties: 274.24 mills Boone 255 mills Marion 239 mills Marshall 247.2 mills Monongalia
Coal Fee Rents/ Lease Charges	None	None
Nonresidents Withholding Tax	None	None
License Fees	None	None
Work Requirements, Fees	None	None
Black Lung Tax	None	None
Abandoned Mine Lands Fee	None	None
Reclamation Bonding and Fees	Minimum bond $10,000, alternative bonding; reclamation tax when fund below minimum	Minimum $10,000; $1000/ acre, alternative bond; reclamation tax when fund below minimum, $0.01/ton

* Taxes and charges as of January 1, 1989.
** County property tax rates may vary according to classification of property.

Mining companies, for purposes of determining Federal taxable income, are permitted to deduct from revenues all operating costs, interest on debt, depreciation on equipment and real property, and percentage depletion. Operating costs include mining and milling costs, marketing and transportation costs, municipal taxes, private royalties, and general administrative charges.

Under Federal law, for property placed in service after 1986, the modified accelerated cost recovery system (MACRS) is the applicable depreciation method with respect to equipment (i.e., property with 3-, 5-, 7-, or 10-year lives):

(1) the 200 percent declining balance method,

(2) switching to the straight line method for the first taxable year for which using the straight line method with respect to the adjusted basis as of the beginning of such year will yield a larger allowance.

In the case of 15- and 20-year property, a 150 percent declining balance method is used. For nonresidential real property, which has a recovery period of 31.5 years, the straight line depreciation method applies.

Percentage depletion for coal and lignite mines under U.S. code in 1988 was 10 percent of the gross income from the property. Excluded from the gross income are any rents or royalties paid or incurred by the taxpayer in respect to the property. However, for tax years beginning after 1986, the corporate percentage depletion deduction for coal (including lignite) is reduced by 20 percent, resulting in an effective corporate percentage depletion rate of 8 percent. The percentage depletion allowance may not exceed 50 percent of the taxpayer's taxable income from the property, computed without allowance for depletion. Percentage depletion is part of a tax preference item used in calculating the alternative minimum tax.[1]

Coal mines located on Federal lands are also responsible for the lease rental on the acreage mined, including a lease bonus bid for the rights to the property. Coal mines on Federal lands also must pay a royalty of 12.5 percent of the mine-mouth value of the coal extracted from surface mines and 8 percent of the mine-mouth value of coal extracted from underground mines.

Foreign corporations are subject to a withholding tax of 30 percent of income, except those corporations engaged in trade or

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[1]For details, see Income Taxation of Natural Resources, by C.W. Russel and R.W. Bowhay, Prentice Hall, 1989, pp. 1103 - 1106.

business within the United States. Foreign corporations engaged in trade or business in the United States are subject to the same corporate taxes as domestic corporations.

The Federal Government also levies a special excise tax on every ton of coal mined; it is known as the black lung tax. The proceeds of this tax go to a special Black Lung Disability Trust Fund, which is used to compensate miners for total permanent disability caused by pneumoconiosis (which includes black lung) and other industrial respiratory diseases caused by the inhalation of coal and rock dust. This fund was established in 1978 to compensate those miners suffering as a result of these occupational health hazards. Public Law 99-514 raised the level of payment to this fund, beginning April 1, 1986, to $1.21/mt of coal mined underground and $0.61/mt of coal from surface mines. However, the amount of tax may not exceed 4.4 percent of the price received by the producer. Lignite is exempt from the tax.

Another charge levied on every ton of coal mined in the United States is the abandoned mine lands reclamation fee. Proceeds go into the Abandoned Mine Reclamation Fund, which is administered by the Secretary of the Interior. The fund is used primarily for the reclamation of land and water resources adversely affected by past coal mining. The fee is set at $0.39/mt of coal produced by surface coal mining and $0.17/mt of coal produced by underground mining, or 10 percent of the value of the coal at the mine, whichever is less. The reclamation fee for lignite coal is set at a rate of 2 percent of the value of the coal at the mine, or $0.11/mt, whichever is less.

The Surface Mining Control and Reclamation Act of 1977 (SMCRA) was enacted to ensure the adequate reclamation of all areas disturbed by surface coal mining operations. At the time of SMCRA's passage, many abandoned, unreclaimed surface and underground mines existed in the United States and posed both health and safety hazards to surrounding communities.

Some of the more important provisions of the SMCRA include the requirement that a reclamation plan must be filed by the coal operators and that the operators must post a reclamation bond to ensure that the reclamation work will be done, either by the operator or by the State, if necessary. Under the concept of primacy, individual States can set their own reclamation standards and bonding requirements, as long as those standards are approved as part of the State's surface mining program and are consistent with 30 CFR 800.14(a).

Almost all of the coal-producing States have developed their own reclamation standards and bonding requirements. Under Federal codes, the State regulatory authority may adopt reclamation standards and bonding requirements that differ from the Federal regulations, as long as those State programs have

been approved. Alternate bonding requirements and levels are also allowed as long as (1) the alternative assures that the regulatory authority will have available sufficient money to complete the reclamation plan for any areas that may be in default at any time and (2) the alternative provides a substantial economic incentive for the permittee to comply with all reclamation provisions.[2] Only Tennessee is currently under the auspices of the Federal Office of Surface Mining and Reclamation Enforcement.

Section 507 of the SMCRA requires each applicant to submit, as part of the permit application, a reclamation plan of sufficient detail to demonstrate compliance with State or Federal standards for reclamation. Section 509 requires that a bond be filed in sufficient amount to cover the cost of reclamation in accordance with the approved plan if such reclamation had to be performed by the regulatory authority in the event of forfeiture. Bonds must be filed with the regulatory authority after a coal mining permit application has been approved but before the permit is issued. The amount of the bond is set by the regulatory authority, either State or Federal, and is based on an analysis of the applicant's estimated cost of reclamation and the requirements of the approved reclamation plan.

The Federal guidelines for determining bonding amounts use standard engineering cost-estimating procedures to develop site-specific costs for each reclamation activity. Bonds calculated in this fashion account for differences in mining site conditions and in postmining land uses. States are not bound to use the Federal guidelines for determining bond amounts if they have an approved surface mining program.

Federal regulations on reclamation bonds specify a minimum bond of $10,000 per permit area. The operator also must carry liability insurance for bodily injury and property damage caused by mining operations with a minimum coverage of $300,000 for each occurrence and $500,000 aggregate.[3]

Alabama State Taxes

Alabama imposes income taxes, excise and privilege taxes, severance taxes, sales and use taxes, and property taxes on mining operations in the State. Coal operators with leases to State-owned lands are subject to State coal royalties. Alabama also has reclamation bonding requirements for coal mines. Federal taxable income is not used as State tax base income. Alabama allows Federal depreciation allowances but does not allow

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[2] 30 Code of Federal Regulations, Section 800.

[3] Ibid., Section 800.14 (a) and (b).

Federal depletion. Federal income tax is deductible for State tax purposes.[4]

Corporate Income Tax -- Corporate income tax is 5 percent of taxable net income. Taxable net income is gross income less allowable deductions: business expenses, interest on debts to acquire securities whose interest is exempt, taxes paid or accrued for special assessments and State income taxes, Federal income taxes paid or accrued, reasonable allowance for depreciation and cost depletion, charitable contributions, contributions to employee trust or annuity plans, and investments in pollution control devices. A deduction is allowed for the sum of net operating losses carried forward to the tax year but cannot exceed $600,000 per tax year; there is a 15-year net operating carry-forward but no carry-back is allowed.

Royalty -- Alabama charges a royalty for coal mined on State-owned lands. The royalty rate is set as a result of competitive bidding for the property and must be at least $3.30/mt. In practice royalties have varied from 12.5 to 18.75 percent of gross sales price. Royalties on private lands are negotiated.

Severance Tax -- Excise and privilege tax on coal mined in Alabama is $0.15/mt. In addition to the coal excise and privilege tax, every entity severing coal or lignite is subject to a severance tax of $0.22/mt of coal or lignite. The total severance tax, including the excise and privilege tax, is $0.37/mt.

Property Tax -- Property taxes are paid to both the State and the municipalities. Class II property[5] is assessed at 20 percent of fair and reasonable market value. Market value of land and improvements above ground is based on the depreciated cost method. Equipment is assessed at 20 percent of the reported value. The Alabama State property tax rate is 0.65 percent. The tax rate for Jefferson County is $4.21 per $100 of assessed value; for Tuscaloosa, Fayette, and Walker Counties, the rates are $2.65, $2.50, and $2.35, respectively, per $100 of assessed value.

Sales and Use Tax -- Alabama has a gross receipts sales tax on machines and parts used in mining and quarrying of 1.5 percent. Jefferson and Tuscaloosa Counties have sales and use taxes that

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[4]Commerce Clearing House State Tax Guide.

[5]Property other than that used in utilities business; agricultural, forest, and single-family owner occupied residential property; historic buildings and sites; and private passenger autos and pickup trucks of 8,000 pounds or less not operated for hire, rent, or compensation.

are not administered by the State. Jefferson County's sales and use tax rate is 0.25 percent. Tuscaloosa County's general sales and use tax is 2 percent; 1 percent on motor vehicles.

Reclamation Bonds -- Alabama's reclamation bonding requirements are set at a minimum of $10,000. The total bonding requirement is set by officials of the State's Environmental Management Department and must cover the entire estimated cost of reclamation for the affected area. The estimated costs of reclamation must be submitted by the permittee in accordance with established rules. Liability for reclamation continues for a minimum of 5 years after the last year of reclamation work. Surety bonds, collateral bonds, and self-bonding are acceptable, given State regulations on bonding are followed. Collateral bonds, if in the form of securities or other collateral, must be at market value; other forms of collateral such as certificates of deposit or letters of credit must be in accordance with established regulations.[6]

Virginia State Taxes

Virginia's taxes on coal operations include corporate income taxes, property taxes, and sales and use taxes on personal property. Virginia does not have any State-owned land leased to coal operations. Virginia has a special reclamation fund tax that is levied against coal producers whenever the fund falls below specified limits.

Corporate Income Tax -- Taxable income is based on Federal taxable income with some adjustments made for State tax determination. Federal taxes paid are not deductible in determining Virginia taxable income. Virginia allows deductions for Federal depreciation and depletion. Tax losses may be carried forward 15 years or carried back 3 years. The corporate income tax rate is 6 percent. No alternative minimum tax is assessed on corporate income.

Property Tax -- Coal and other mineral lands are subject to local taxation only. Land, building, and improvements are assessed at 100 percent of fair market value. Machinery and tools used in mining are valued at 70 percent of cost depreciated at 20 percent per year until depreciated cost equals 20 percent of original cost. Coal is valued at $500/acre for unmined coal and $300/acre of coal being mined during the year. The tax rate for Lee County is $0.73 per $100 of valuation. Buchanan,

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[6]Rules of Alabama Surface Mining Commission, Chapter 880-X-9, "Bond and Insurance Requirements for Surface Coal Mining and Reclamation Operations. General Requirements for Bonding of Surface Coal Mining and Reclamation Operations."

Dickenson, and Wise Counties assess $0.59, $0.53, and $0.39 per $100 of valuation, respectively, for real estate and coal, and $1.95, $2.19, and $1.15 per $100 of valuation, respectively, for machinery.

Sales and Use Tax -- A sales and use tax is imposed on the sales price of motor vehicles at the rate of 3 percent. The sales and use tax is paid by the purchaser or user when the certificate of title is issued. There is no sales tax on coal sold for domestic consumption. A sales and use tax of 3.5 percent is applied to the retail sales price of goods and services.

Reclamation Tax -- Coal production is taxed at the rate of $0.022 per clean mt of coal produced by a surface mining operation permitted under the Virginia Coal Surface Mining Control and Reclamation Act; $0.011/mt of clean coal produced by deep mining; and $0.0055/mt of clean coal processed or loaded by preparation or loading facilities. The operator is relieved of paying the reclamation fund tax on total coal production in excess of 4.5 Mmt each calendar year. As of July 1, 1987, the reclamation tax is payable when the reclamation fund balance is less than $1,750,000 and continues to be payable until the balance in the reclamation fund exceeds $2 million.[7]

Reclamation Bonds -- Virginia's reclamation bonds are set by the Department of Mines, Minerals, and Energy. The minimum bond is set by law at $10,000. Reclamation plans must be submitted with the mining permit application. Single or incremental bonding methods may be used. Bonds may be increased or decreased periodically as the area requiring bond coverage is increased or decreased or where the cost of future reclamation changes. The bond must cover the entire permit area; it continues for at least 5 years past the date of final reclamation activities for land to be returned to long-term intensive agricultural use. The Director of the Division of Mined Land Reclamation has broad police powers to enforce reclamation, including right of entry, acquisition, and disposition.[8]

Self-bonding, surety bonds, collateral bonds, escrow accounts, or a combined surety and escrow account are acceptable, provided State regulations on bonding are followed. Collateral bonds, such as certificates of deposit or letters of credit, must be in accordance with established regulations. Self-bonding may be accepted, providing the firm has followed State regulations

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[7]Virginia Coal Surface Mining Control and Reclamation Act of 1979, Chapter 19, Article 5.

[8]Virginia Coal Surface Mining Control and Reclamation Act of 1979, Chapter 19.

concerning designated agents, adequate solvency, net worth, and a history of continuous operations, etc.

Alternative bonding in Virginia is available through the Virginia Pool Bond Fund. The initial membership fee is $1,000. For underground mining operations, the bond is $1,000/acre covered by the permit application, and the minimum is $10,000. For surface operations, the amount of the bond is $1,500/acre for each acre to be surface mined, with a minimum of $25,000. Other rates and minimums exist for combination mining and preparation facilities. Self-bonding is also possible under this program.

Release of reclamation bonds entails public notice, notice to specific interested parties, and inspection of the property. Bonds may be partially released, depending on the progress of the reclamation work. The entire bond may not be released until all reclamation work has been completed and the prescribed time period for monitoring has passed. The public notices must summarize the reclamation plan, give the date and nature of work performed, and describe the results of the reclamation work. Objections and request for a public hearing may be filed with the director within 30 days of the public notice. The director must inform all interested parties and hold a public hearing within 30 days of the request.

West Virginia State Taxes

West Virginia's taxes on coal operations include a corporate income tax, a business occupation tax, sales and use taxes on personal property, and property taxes. West Virginia does not have any State-owned land leased to coal operations, although provisions are made for royalties to be negotiated in contracts for State leases. West Virginia also has a special reclamation fund tax that is levied against coal producers whenever the fund falls below specified limits.

Corporate Income Tax -- State taxable income is based on Federal taxable income with certain modifications (Sec. 11-24-6). Federal income tax is not deductible. The corporate tax rate is 6 percent for the first $50,000 of taxable income, and 7 percent for the remainder over $50,000. For tax periods beginning on or after July 1, 1987, the tax rate is 9.75 percent with an annual decrease in the tax rate of 0.15 percent for 5 successive years, with the rate to be 9 percent after July 1, 1992 (Sec. 11-24-4). The average tax rate for 1988 is 9.675 percent. No alternative minimum tax is assessed on corporate income.

Severance, Business, and Occupation Tax -- West Virginia's severance tax is the most significant tax levied against a coal producer in West Virginia. For the evaluation, the tax categories affecting coal operations include severance,

extraction, and production of coal. Prior to July 1987, the rate was 3.85 percent of the mine-mouth value under the business and occupation (B&O) tax. Effective July 1987, the B&O tax was repealed and replaced with a severance tax of 3.85 percent of the mine-mouth (before washing) value of the coal plus 0.88 percent of the sales value of washed coal. This tax includes a tax of 0.35 percent for the benefit of counties and municipalities.

An annual credit of $500 is allowed for the amount of severance tax liability, but not to exceed 50 percent of the State corporate income tax liability of the taxpayer for the tax year. The entire amount of the severance tax liability that was taken as a deduction in determining Federal taxable income must be an adjustment increasing Federal (and State) taxable income. In lieu of claiming the credit, the taxpayer may elect not to increase its taxable income and thereby take as a full deduction the amount of its severance tax liability for the tax year.

Property Tax -- West Virginia's property taxes are administered by State and county officials. Each county, municipality, and board of education can levy its own property tax rates. Class III property is described as all real and personal property situated outside municipalities, exclusive of Classes I and II (agricultural property, residential property, or evidences of debt). The basis for tax assessment is 60 percent of fair market value. In Boone County, the 1989 tax rate was $2.7424 per $100 of assessed value. Class III and Class IV property in Marion, Marshall, and Monongalia Counties are taxed an average of $2.55, $2.39, and $2.472 per $100, respectively, of assessed value.

In addition, each county assesses the value of the underlying coal by assessing the minable coal acreage at varying rates. Boone County assesses coal at a value of approximately $300/acre, depending on the coal type and quality. The total coal value is multiplied by 0.6 to determine the taxable basis before multiplying by the mill levy rate.

Sales and Use Tax -- An excise tax is imposed on the use of tangible personal property furnished and delivered within the State to users and consumers. The tax rate of 6 percent is applied to the purchase price.

Reclamation Bonds -- West Virginia's reclamation bonding levels are set by law at $1,000 for each acre or fraction thereof, with a minimum bond of $10,000. The bond must cover the entire permit area and continues for the full term of the permit plus any additional period necessary to achieve compliance with the requirements in the reclamation plan of the permit.[9]

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[9] West Virginia Code, Section 22A-3-11.

Surety bonds, collateral bonds, or self-bonding is acceptable, provided State regulations on bonding are followed and the form of the performance bond is approved by the commissioner of the West Virginia Department of Energy. Collateral bonds, if in the form of securities or other collateral, must be at market value; other forms of collateral such as certificates of deposit or letters of credit must also be valued at market value and be in accordance with established regulations. Self-bonding may be accepted without separate surety if the applicant demonstrates to the satisfaction of the commissioner the existence of a suitable agent to receive service of process and a history of financial solvency and continuous operation sufficient for authorization to self-insure.

The commissioner may approve an alternative bonding system if it can reasonably assure that sufficient funds will be available to complete the reclamation, restoration, and abatement provisions for all permit areas that may be in default at any time and provide a substantial economic incentive for the permittee to comply with all reclamation provisions.

West Virginia also has a special reclamation fund for reclamation of mines abandoned after 1977 and on which the posted reclamation bonds (now forfeited) will not cover the costs of reclamation. When the fund sinks below $1 million in any one quarter, a tax of $0.011/mt clean coal is levied on every coal producer in the State until such time at the end of the quarter that the fund contains more than $2 million. Taxes transferred into the special reclamation fund are not subject to refund.

APPENDIX C

DESCRIPTION OF POLISH COAL MINES

This appendix expands the description in chapter 2 of the Polish coal industry and gives details on the Polish reserve classification system, the Polish coal standard, and all the major Polish coal mines. Additional information covers data on coal quality and use, typical mining operations, regulatory requirements, and tax regimes.

As is the case with many former Communist countries, operational information on individual mines is relatively scarce by Western standards. Details on such operations were, until very recently, considered state secrets. The authors of this report acknowledge the shortcomings in the presentation of operational detail compared with previous reports of this type.

All of the Polish mines used in this study are located in Upper Silesia, which in 1990 produced 99 percent of the nation's salable output of hard coal. All of the major mines in Silesia are listed in Table C.1, describing location, year of startup (if available), production, employment, and typical coal quality for 1990 production. All of the Polish mines use the single-entry longwall mining system. The significant differences among Polish mines arise from operational considerations such as age, whether the mine is in a populated area, special practices necessitated by geology or regulation (top slicing, stowing, multiple seams, or some combination thereof), and special problems encountered (high water inflows, saline water, spontaneous combustion, extensive faulting, or tectonic stresses). The Burdyk mine, which is under construction in the Lublin Basin, is not listed in the table.

Historical Review of Coal Mining in Poland

Poland has a long and colorful history of coal mining. The first recorded coal mines in Poland were from the 1300's in Lower Silesia. Upper Silesia has figured prominently in both history and production for the last 200 years, as the area changed sovereignty several times. The most recent international controversy over the area occurred when the Federal Republic of Germany declared a quitclaim over the region, recognizing the existing Polish borders as inviolate, in order to win international support for unification with the German Democratic Republic. Ethnic Germans in Silesia historically have been able to qualify for a German pension by relocating to German territory and presenting proof of German ancestry to the proper authorities.

TABLE C.1
Major Polish Hard Coal Mines,
Mine Summary Data

Mine Name	Region	Startup Year	Production: Raw Coal Metric Tons 1989	Production: Raw Coal Metric Tons 1990	Production: Salable Coal Metric Tons 1989	Production: Salable Coal Metric Tons 1990	Total Employment 1990	1990 Quality Parameters: Heat Content Btu/lb	1990 Quality Parameters: Ash %	1990 Quality Parameters: Sulfur %
1-GO Maja	W.U. Silesia	1960	3,856,632	3,276,751	2,159,962	1,916,220	6,471	12,429	7.5	0.6
Andaluzja	N.U. Silesia	pre-1945	3,590,348	2,688,794	3,009,571	2,335,875	5,326	9,701	15.2	0.7
Anna	W.U. Silesia	pre-1945	3,398,724	2,835,937	1,944,780	1,645,282	5,424	12,040	10.5	0.8
Barbara-Chorzow	N.U. Silesia	pre-1945	1,563,949	1,380,659	1,035,271	874,294	2,868	9,414	20.4	1.0
Bobrek	N.U. Silesia	pre-1945	2,099,351	1,795,306	1,805,566	1,556,077	3,493	11,352	11.2	0.5
Bogdanka	E.U. Silesia	pre-1945	2,646,247	2,414,998	1,904,226	1,761,649	4,845	7,766	32.4	1.2
Boleslaw Smialy	W.U. Silesia	pre-1945	4,105,025	3,688,111	2,976,556	2,601,948	4,690	9,046	24.3	1.1
Borynia	W.U. Silesia	1971	5,391,664	4,981,892	2,724,569	2,419,397	6,418	11,755	10.5	0.7
Brzeszcze	E.U. Silesia	pre-1945	5,287,481	4,409,778	3,560,500	2,960,540	8,392	9,825	21.2	0.5
Centrum	N.U. Silesia	pre-1945	2,433,108	2,067,859	1,967,975	1,675,211	4,335	10,416	13.9	0.6
Chwalowice	W.U. Silesia	pre-1945	3,394,088	2,935,104	2,145,382	1,828,789	4,420	9,846	15.5	1.0
Czeczott	E.U. Silesia	1985	2,635,911	3,155,648	1,990,487	2,531,431	6,744	8,966	21.0	0.9
Debiensko	W.U. Silesia	pre-1945	3,877,057	3,266,338	1,865,595	1,620,905	5,808	10,967	14.7	0.8
Gliwice	W.U. Silesia	pre-1945	2,496,735	2,178,061	990,785	968,750	5,917	13,006	9.3	0.9
Grodziec	E.U. Silesia	pre-1945	1,173,815	1,003,660	847,781	709,456	2,356	8,479	25.4	0.6
Halemba	W.U. Silesia	1957	7,299,961	5,656,825	5,282,379	4,187,712	8,784	10,398	18.5	0.7
Janina	E.U. Silesia	pre-1945	4,416,275	3,330,846	3,608,072	2,734,197	6,275	8,345	13.5	1.4
Jankowice	W.U. Silesia	pre-1945	7,188,389	5,547,193	4,751,133	3,629,640	7,551	9,293	23.7	0.6
Jastrzebie	W.U. Silesia	1963	3,854,016	3,487,601	2,626,492	2,294,419	6,514	12,263	9.5	0.6
Jaworzno	E.U. Silesia	1953	5,844,323	4,054,989	4,628,228	3,311,994	7,877	7,694	20.0	1.5
Jowisz	E.U. Silesia	pre-1945	1,526,169	1,363,689	1,161,903	939,083	3,164	8,766	21.9	1.1
Julian	N.U. Silesia	1954	2,787,279	2,324,657	2,231,040	1,871,276	4,396	9,620	15.3	0.8
Katowice	W.U. Silesia	pre-1945	1,287,983	1,271,450	1,131,131	1,097,921	3,584	11,438	9.1	0.7
Kazimierz-Juliusz	E.U. Silesia	pre-1945	2,091,630	1,748,270	1,524,073	1,222,961	4,531	8,814	19.6	0.6
Kleofax	N.U. Silesia	pre-1945	3,157,277	2,898,589	2,737,396	2,504,372	4,819	11,209	11.0	0.8
Knurow	W.U. Silesia	pre-1945	6,996,132	5,941,299	4,105,510	3,623,246	9,462	10,312	19.0	1.0
Komuna Paryska	E.U. Silesia	pre-1945	2,212,620	1,446,861	1,848,034	1,229,475	4,013	7,631	20.3	1.5
Krupinski	W.U. Silesia	1983	3,631,587	3,196,800	1,283,000	1,358,145	4,947	10,445	15.2	0.7
Makoszowy	W.U. Silesia	pre-1945	6,378,736	5,293,644	4,574,018	3,878,635	8,146	9,781	22.1	1.0
Marcel	W.U. Silesia	pre-1945	3,160,476	2,813,598	1,974,551	1,761,079	4,848	11,604	10.3	0.7
Miechowice	N.U. Silesia	pre-1945	2,549,957	1,903,397	2,187,003	1,585,906	3,256	10,901	14.9	0.5
Morcinek	W.U. Silesia	1985	1,079,349	1,121,607	669,300	668,812	3,333	11,641	9.3	0.6
Moszczenica	W.U. Silesia	1965	4,007,805	3,226,490	2,670,733	2,059,794	6,967	12,860	7.6	0.6
Murcki	N.U. Silesia	pre-1945	4,090,878	3,509,291	2,912,837	2,475,366	5,031	8,762	23.6	0.7
Myslowice	N.U. Silesia	pre-1945	2,754,988	2,427,319	2,016,810	1,865,169	4,451	10,113	15.7	0.6
Niwka-Modrzejow	E.U. Silesia	pre-1945	2,552,898	1,720,315	1,935,336	1,369,086	5,008	9,014	18.7	0.7
Nowa Ruda	L. Silesia	pre-1945	2,150,868	1,801,163	730,561	628,463	5,611	11,583	9.6	0.7
Nowy Wirek	W.U. Silesia	1955	3,366,204	2,668,399	2,321,820	1,866,920	4,329	11,270	13.5	0.5
Paryz	E.U. Silesia	pre-1945	1,730,788	1,402,814	1,367,605	1,063,370	3,975	9,760	12.6	0.8

TABLE C.1 (Continued)
Major Polish Hard Coal Mines,
Mine Summary Data

Mine Name	Region	Startup Year	Production: Raw Coal Metric Tons 1989	Production: Raw Coal Metric Tons 1990	Production: Salable Coal Metric Tons 1989	Production: Salable Coal Metric Tons 1990	Total Employment 1990	Quality Parameters: Heat Content Btu/lb	Quality Parameters: Ash %	Quality Parameters: Sulfur %
Piast	E.U. Silesia	1975	8,643,713	7,193,313	7,353,775	6,175,164	9,712	8,828	18.7	1.1
Pniowek	W.U. Silesia	1974	6,841,395	5,844,295	3,776,620	3,325,170	8,360	12,012	8.6	0.7
Pokoj	W.U. Silesia	pre-1945	2,914,098	2,559,478	2,330,538	1,951,952	4,114	11,195	15.9	0.6
Polska	N.U. Silesia	pre-1945	1,415,188	1,202,170	1,237,792	1,088,020	3,288	12,021	10.0	0.8
Porabka-Klimontow	E.U. Silesia	pre-1945	3,098,274	2,247,495	2,147,468	1,769,907	5,933	9,246	15.6	0.7
Powstancow Slaskich	N.U. Silesia	pre-1945	3,869,253	3,067,086	3,173,859	2,391,421	7,016	10,403	14.8	0.6
Pstrowski	W.U. Silesia	pre-1945	2,005,883	1,628,869	1,268,341	1,064,251	5,900	9,755	20.8	1.2
Rozbark	N.U. Silesia	pre-1945	3,380,850	2,376,518	2,572,494	1,766,997	4,315	9,288	18.4	0.7
Rydultowy	W.U. Silesia	pre-1945	4,002,783	3,767,882	2,577,695	2,314,994	5,645	10,885	12.5	0.8
Rymer	W.U. Silesia	pre-1945	1,793,801	1,581,523	1,235,013	1,113,812	3,519	10,322	20.6	0.9
Saturn	E.U. Silesia	pre-1945	1,901,788	1,599,599	1,224,786	1,026,517	4,234	9,301	17.6	0.9
Siemianowice	N.U. Silesia	pre-1945	3,700,065	3,013,428	2,661,406	2,982,372	6,040	10,150	18.0	0.9
Siersza	E.U. Silesia	pre-1945	4,194,581	2,823,690	3,677,549	2,475,218	6,310	7,153	19.1	2.1
Silesia	E.U. Silesia	pre-1945	2,270,425	1,795,456	1,435,865	1,180,652	3,382	9,006	20.8	0.8
Slask	W.U. Silesia	1974	3,226,551	2,470,987	2,553,526	2,003,618	4,053	11,171	15.3	0.6
Sosnica	W.U. Silesia	pre-1945	6,114,644	5,032,803	4,363,120	3,330,583	8,153	10,284	18.7	0.9
Sosnowiec	E.U. Silesia	pre-1945	1,700,649	1,409,985	1,332,738	1,060,441	4,165	8,660	18.5	0.9
Staszic	N.U. Silesia	1964	5,393,477	5,148,607	4,173,953	4,129,895	7,427	9,390	22.8	0.7
Szczyglowice	W.U. Silesia	1961	5,978,702	5,563,035	4,336,923	3,710,376	8,053	9,888	23.7	0.9
Szombierki	N.U. Silesia	pre-1945	1,161,922	924,993	724,889	719,087	3,142	11,093	11.3	0.6
Thorez	L. Silesia	pre-1945	1,014,842	796,570	418,569	315,205	3,488	12,629	7.6	0.8
Viktoria	L. Silesia	pre-1945	1,362,905	962,072	467,036	358,740	4,179	11,946	8.2	0.9
Walbrzych	L. Silesia	pre-1945	1,326,276	942,892	539,832	434,282	3,975	12,294	6.7	0.9
Wawel	W.U. Silesia	pre-1945	1,996,624	1,713,282	1,228,194	1,120,014	3,532	11,424	13.0	0.7
Wesola	N.U. Silesia	1952	6,075,774	4,881,500	4,742,762	3,879,412	7,430	8,927	24.9	0.5
Wieczorek	N.U. Silesia	pre-1945	3,527,054	2,972,959	2,681,364	2,234,439	5,891	10,035	18.1	0.7
Wujek	N.U. Silesia	pre-1945	2,953,246	2,173,473	2,187,171	1,745,728	5,561	11,105	14.6	0.7
Zabrze-Bielszowice	W.U. Silesia	pre-1945	6,820,307	5,383,604	5,093,612	3,946,906	9,863	10,190	21.3	0.7
Ziemowit	E.U. Silesia	1952	9,698,558	7,787,574	7,882,748	6,413,503	10,612	8,863	18.5	1.1
ZMP	W.U. Silesia	1979	2,420,479	2,118,971	945,970	840,850	4,081	11,767	10.7	0.7
Zofiowka	W.U. Silesia	1969	5,862,518	5,211,336	2,872,714	2,667,272	8,151	12,365	7.4	0.6
TOTALS/AVERAGE			**250,733,348**	**208,431,447**	**174,426,293**	**146,169,663**	**387,903**	**10,054**	**17.1**	**0.8**

Compiled from: Zestawienie Wskaznikow Techniczno-Ekonomicznych Kolpaln, Za Rok 1989 and Zestawienie Wskaznikow Techniczno-Ekonomicznych Kopaln, Za Rok 1990, Centralny Osrodek Informatyki Gornictwa.
Polish Coal -- General Outlook, State Coal Agency, PLC, Katowice, October 1991.

ABBREVIATIONS FOR REGIONS: E.U. Silesia -- Eastern Upper Silesia
N.U. Silesia -- Northern Upper Silesia
W.U. Silesia -- Western Upper Silesia
L. Silesia -- Lower Silesia

Categories of Polish Mineral Reserves[1]

The categories of mineral (including coal) reserves are based on the level of certainty, density and type of directly relevant observation points and data, including: geological data, drilling and analytical results, and various types of exploratory-mining (i.e., exploratory shafts, adits, drifts, etc.) documentation. The categories also depend on the type and the quality of the mineral resource, and the level of the geological and mining investigations pertaining especially to the mining conditions.

Generally, the following mineral reserve categories are recognized (i.e, regulated by the State norms, mining and geological laws) in Poland:

Inferred (i.e. perspective or "Category D") -- based on general geological data, mineral occurrences, analogy to anticipated model, lack of data for more detailed evaluation.

C_2 (probable)--determined on the basis of a relatively well-known geology and the deposit type. Data include: surface outcrops, drilling results, exploratory mine workings, all they permit to determine the geological conditions and approximate boundaries of the deposit--although with possible multiple interpretation referring to its geometry and tectonics. The error in estimated reserves cannot exceed 40 percent.

C_1 (preliminarily proven)--based on the drilling data and exploratory mine excavations regularly spaced within the deposit (in the grid or lines). The density of measured points is determined by special regulations and depends on the deposit type and its variability group. The error in estimated reserves cannot exceed 25 percent.

Note: C_2 + C_1 reserves can be considered as "demonstrated" (in U.S. Bureau of Mines' and U.S. Geological Survey's classification; 1976, 1980).

B (proven, i.e. measured)--based on the regularly and closely spaced drilled holes or exploratory mine workings. The density of measured points is determined by special regulations and depends on the deposit type and its variability group. The error in the reserves calculation cannot exceed 15 percent.

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[1]This classification system was provided by the Polish authorities and has been reproduced verbatim.

A (proven -- measured including "recoverable" or "operatable")-- i.e. factually produced, sometimes including non-economic material and/or waste rocks). Based on mine preparatory workings--including upfront drillings. The spacing between preparatory mine excavations and/or upfront drillings is determined by special regulations and depends on the deposit type, its variability group and planned mining method. The error in calculated reserves cannot exceed 10 percent, sometimes 5 percent.

TABLE C.2
Polish Mineral Reserve Categories*

Mineral Deposit Group	Mineral Reserve Categories and Distance in meters Between Drill Holes or Mine Excavations for Each Category			
	C2	C1	B	A
I	4000-3000	3000-1500	1500-1000	mine excavations in distance up to 500 m
II	3000-1500	1500-1000	1000-500 excavations including at least one mine	mine excavations up to 300 m
III	1500-1000	1000-500	mine excavations 100-250	mine excavations up to 200 m

* Polish Authorities.

In accordance with the size of the deposit, variability of its form and structure and the variability type and the quality of the mineral resource are differentiated in the three following groups:

Group I--consists of mineral deposits (including coal) or those parts which are characterized by simple geological structure and a thickness which considerably exceeds the assumed economic limits, and undifferentiated quality variability, particularly with reference to: stratified type sedimentary deposit, undisturbed or weakly disturbed tectonics with consistent mineral composition.

Group II--consists of mineral deposits or those parts characterized by complex geology, differentiated thickness and considerable variability in the content of the main components of the deposit, particularly with reference to: stratified type ore body, variation in thickness, and various

mineralization or various chemical-, mineral-, and petrographic composition, indicating tectonic disturbances.

Group III--consists of mineral deposits (including coal) or those parts characterized by very complex and differentiated geology and great variability in thickness and quality of the deposit, particularly with reference to: stratified type ore body, variation in thickness, quality of the deposit, and tectonic complexity.

Polish Coal Quality Classifications

Table C.3 identifies the Polish Coal Standard. The coal name appears to correspond to the nomenclature commonly used by Europeans to describe use and characteristics. When the names were first coined, probably in the late 1700's or early 1800's, it was common to produce town gas (synthetic gas derived by mild pyrolysis) from coal, hence the name "Gas coal".

Table C.3
Polish Coal Standard*

Coal Name	Mark	Volatile Matter	Coking Property (by Roga)
Flame Coal	31	28% & over 35 - 44%	5 & less
	32	28% & over 33 - 40%	6 - 20
Gas Flame Coal	32.2	28% & over 33 - 40%	21 - 45
Gas Coal	33	28% & over	46 - 55
Gas & Coking Coal	34	28% & over	55 & over
	35.1	27 - 31%	45 & over
Coking Coal	35.2	21 - 26%	45 & over
Metallurgical Coking Coal	36	14 - 20%	45 & over
Semi-Coking Coal	37	15 - 28%	5 & over
Poor Quality Coal	38	15 - 28%	5 & over
Anthracite	41	11 - 14%	0

* 1986 Coal Manual, The TEX Report, Ltd., Tokyo, Japan.

Polish Government Regulation and Control

The Polish coal industry is regulated by the Central Government. The Government owns all the coal reserves, conducts virtually all exploration activities, and regulates health, safety, environmental practice, transportation and taxes. Exports are no longer the sole province of the state-owned corporation Weglokoks, but Weglokoks does have a majority of the mines under contract, and the Government also levies taxes on

coal exports. While the central command structure on the coal industry has been pared back since 1989, some vestiges of the command system remain, principally through price controls.

Although the requirement that all coal sales be conducted through the Central Coal Bureau was lifted in 1990, price increases must still be approved by the local tax districts. The Katowice tax district, which controls the mine-mouth coal prices for the mines in Upper Silesia, has been limiting prices increases to approximately 5 percent per month.

The first important piece of enabling legislation for regulation of the Polish coal mines is the Uniform Text Decree on the Mining Statutes of 1978. This legislation amends previous legislative acts passed in 1946, 1953, 1961 and 1964. The 1978 legislation is fairly general and does not specify detailed engineering standards required by the mines. Additional amendments, executive orders, and regulations to this legislation form the basis for the health and safety practices required of the mines, as well as establishing the financial responsibility of the mines in cases of damage to surface structures. The Polish Parliament is now considering a major revision to the old mining laws to provide a more comprehensive and less confusing set of legislation and regulations. Many of the existing regulations apparently conflict; the result is often an unevenly applied code for mining.

Responsibility for the coal mining operations rests in the State Coal Agency, which is part of the Ministry of Industry. The Ministry of Industry is responsible for assessing fines for noncompliance with mine health and safety regulations. Fines for noncompliance are typically grouped under miscellaneous penalties in the mining cost system employed by the majority of Polish mines. These penalties typically can be the largest line item under taxes and penalties for these mines.

Polish health and safety regulations on mine ventilation limit methane concentrations in working areas to 2 percent, in contrast to U.S. regulations, which limit methane to 1 percent or less in working areas. The maximum level of methane allowed in exhaust shafts in Polish mines is 0.75 percent. The minimum concentration necessary for an explosive ignition of methane and air mixtures occurs at 5 percent methane, but fine coal dust suspended in the mixture can lower the ignition point further. The maximum explosive effect of air-methane mixtures is reached at 10 percent methane concentrations; beyond 15 percent methane concentrations there is usually not enough oxygen to support ignition. While methane is usually dispersed in flowing air, where air circulation is poor, such as at advancing faces and in pockets near the roof, methane has a tendency to build up because it is lighter than air. The margin of safety for methane buildups under Polish mining code is obviously lower than that

under U.S. code. Polish mines are also allowed to ventilate two longwall panels on a single split, or circuit, of intake air. This practice is prohibited for U.S. mines.

Polish mines use the single-entry longwall system common to Europe. U.S. mines, if they wish to use this system, must seek an exemption from the regional Mining Safety and Health Administration office responsible for inspecting the mines. While an in-depth discussion of the merits and drawbacks of both mining systems are beyond the scope of this paper, the choice of systems has serious implications for the practical ventilation and ground control measures necessary to maintain a safe and healthy working environment. Both systems have advantages and disadvantages.

In some populated areas, the Poles are systematically subsiding entire towns. In these cases, adjacent mines in the area must coordinate, by law and negotiated agreement, their longwalls' advance with other mines, often meeting a specific minimum or maximum advance per day or week. Multiple longwall faces are often aligned under such areas, essentially creating one very long face thousands of meters wide, which subsides the entire town evenly and on a coordinated schedule. While this method minimizes the damage to surface structures, it creates serious production scheduling problems for the individual mines and can contribute significantly to the low productivity and resultant high costs at some mines. Barrier pillars are sometimes left under particularly sensitive or important surface features, such as railroad tracks or items of cultural value. In these cases, other areas of the mine are mined-out first, before mining of the barrier pillars is attempted. In isolated cases, the mines are actually subsiding their own shafts, an engineering feat never practiced at U.S. mines.

Polish regulations limit workers at faces with ambient temperatures above 28°C to no more than 6 hours per shift, with frequent rest and cooling breaks, such that no more than 4 hours of actual work per shift may be performed.

New employees at Polish mines receive at least 8 hours of initial training in hazard recognition, first aid, fire protection, labor law, and new mine regulations. Periodic refresher training is also required, but the scheduling of this requirement seemed to vary substantially among the mines visited for this study. Periodic training for all trade groups was listed as either 16 hours every 2 years for all trade groups, or 16-24 hours every 2-5 years, and 8 hours each year. Maintenance personnel and others who service underground mining machinery are also required to receive specialized initial training, periodic refresher training, and retain a certificate of their training.

The maximum allowable noise exposure level for Polish workers over a production shift is 85 decibels.

Polish regulations also make provisions for ambient entrained dust levels and settled combustible dust on the floor, walls, and roof. Because silicosis is more easily contracted and a more serious health problem than pneumoconiosis, Polish regulations on atmospheric or entrained dust set maximum allowable dust levels for Polish mines according to contained SiO_2, as well as respirable dust content:

if SiO_2 is <2%, total dust must be less than 10 mg/m^3;
if SiO_2 is 2-10%, total dust must be less than 4 mg/m^3, and respirable dust must be less than 2 mg/m^3;
if SiO_2 is 10-70%, total dust must be less than 2 mg/m^3, and respirable dust must be less than 1 mg/m^3;
if SiO_2 is >70%, total dust must be less than 1 mg/m^3, and respirable dust must be less than 0.3 mg/m^3.

The maximum amount of settled dust (fine, combustible coal dust that settles on the floor, walls, and roof of the entries) is 30 percent of total. Rockdusting to dilute the combustible coal dust and reduce the dust explosion hazard is practiced at all Polish coal mines. Installation and use of water or dust barriers to contain the propagation of dust explosions is also mandated and practiced at Polish coal mines.

Polish Government Tax Regime

Poland's Central Government is responsible for the assessment of most of the taxes on the coal mining industry. The most significant of these is the 40 percent income tax. Other taxes and charges of interest include the eological fund, Science and Technology fund, reclamation fund, Coal Board fund, and mandatory subsidence insurance. Subsidence assessments and local property and road taxes (enacted in 1990) are levied by the local authorities. For details of individual taxes, refer to Appendix A.

The Polish corporate income tax is 40 percent. State-owned corporations pay the same tax as private corporations. In 1989, most of the mines were subsidized, had domestic prices controlled, and had all exports made through Weglokoks, the state export firm. There was little incentive in this system to either control costs or earn a profit. Few of the mines paid income taxes.

Polish mines are liable for damage to surface structures or surface waters by subsidence. Because Polish law requires the mines to seek 100 percent extraction of the significant coal seams, subsidence of the surface is virtually a foregone

conclusion unless stowing is practiced. Although stowing (placing mine refuse or powerplant fly ash in gob areas) is practiced at many mines, virtually all of the mines incur subsidence damage assessments. Damage assessments are negotiated with a local review committee after a complaint has been filed by an individual. Once an assessment is made, the committee determines which mine is responsible and levies the assessment on the operation. There appears to be some flexibility in the process, as some mines in the study indicated they had an option of doing the repair work with their own crews, paying the assessment, or some combination thereof.

The enabling legislation for environmental regulations is an Act Of Parliament, January 31, 1980 (No. 3/80). The legislation itself is fairly general. Executive orders and specific regulations enacted since then form the practical basis for the operating practices of the mines and the fines imposed for noncompliance. The Ministry of the Environmental Protection, Natural Resources, and Forestry is responsible for levying the fines for noncompliance with environmental regulations.

Environmental regulations specify that fines be levied for discharge of mine water into surface waters. The fines vary according to both the quantity and salinity of the discharge; in some cases the fines can be quite substantial. A distinction is made between four categories of discharge: potable, industrial, salty, and salt water. The dumping of potable and industrial water requires fines for the use of the water resource. For discharge of salty or salt water, or water with excess dissolved minerals, the fine is for the release of the excess mineralization into surface waters. Fines for the release of salty or salt water are often contested and go unpaid by the Polish mines. Most of the problem is centered in Upper Silesia, also known as the Gornoslaski Coal District. Mine water is classified according to the total mineralization in chloride and sulfate ions per 1 liter of water:[2]

Category I: Potable water - up to 600 mg of $Cl^-+SO_4^{2-}/L$
Category II: Industrial water - 600 to 1,800 mg of $Cl^-+SO_4^{2-}/L$
Category III: Salty water - 1,800 - 42,000 mg of $Cl^-+SO_4^{2-}/L$
Category IV: Salt water - above 42,000 mg of $Cl^-+SO_4^{2-}/L$

A Target Fund was in place in 1989, but was discontinued in 1990; this fund was used as a merit pay system for Polish workers. This particular fund was not of consequence to any of the mines examined in this study (less than $0.01/mt) and was therefore not included as a line item in the tax and penalty section of the cost analysis.

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[2]Polish Coal, General Information, The State Hard Coal Agency Joint Company, Katowice, Poland, August 1990.

A significant difference between Polish and U.S. tax laws is that Polish firms can continue to take depreciation on a piece of equipment above the amount of its book value as long as it is in operable condition. This obviously provides an incentive for Polish mine managers to keep equipment in service past its usual life span, and is a contributing factor to the unusually large inventories of equipment maintained by the mines. Delivery inefficiencies and defective equipment also contributed to the problem; mines sometimes stockpiled a year's supply of spare parts because that is how long it usually took for replacement deliveries. Depreciation schedules for equipment classifications can be found in Appendix A.

Inland Rail Transportation

The Polish State Railway, or Polskie Kolwje Panstwowe (PKP), is under the direction of the Ministry of Transport, and operates all of the country's rail lines. Published tariffs, set by the Ministry and approved by the Government, are calculated by commodity class and distance; there is no negotiation over price. Freight tariffs reportedly cover costs by a significant margin.[3] Coal and coke are the largest single commodities moved by the Polish railway system, and together typically account for 40 percent of all commodity traffic by tonnage. Approximately 85 percent of all the coal produced in Poland moves by rail, with most of the remainder consumed at mine-mouth powerplants. Figure C.1 shows the major rail lines from the Silesian coal fields to the export ports.

Approximately half of all coal exports (14.1 Mmt in 1989) move by rail to customers in Germany, Ukraine, Russia, Czechoslovakia, Austria, and other Eastern European countries. The other half (14.8 Mmt) moves by rail to the coal export facilities for ocean transport to both coking and steam coal customers. Distance by rail varies according to the exact mine and port of exit, but generally ranges from approximately 500 to 650 km.

Ports

Poland has coal loading facilities at Gdynia, Gdansk BAZ, Port Polnocny (Gdansk North Port), Szczecin, and Swinoujscie. Only Gdansk North Port and Swinoujscie have the necessary draft for Panamax ships and consequently are larger coal exporting ports. The other ports can fully load Handysize and smaller ships and partially load Panamax vessels, which can be topped off at Gdansk North Port or Swinoujscie. Table C.4 lists the coal and coke exports from Polish ports for 1989.

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[3] Poland: Reform, Adjustment, and Growth, The World Bank, Washington, DC, 1987.

Figure C.1
Polish Coal Resources
and Major Rail Routes

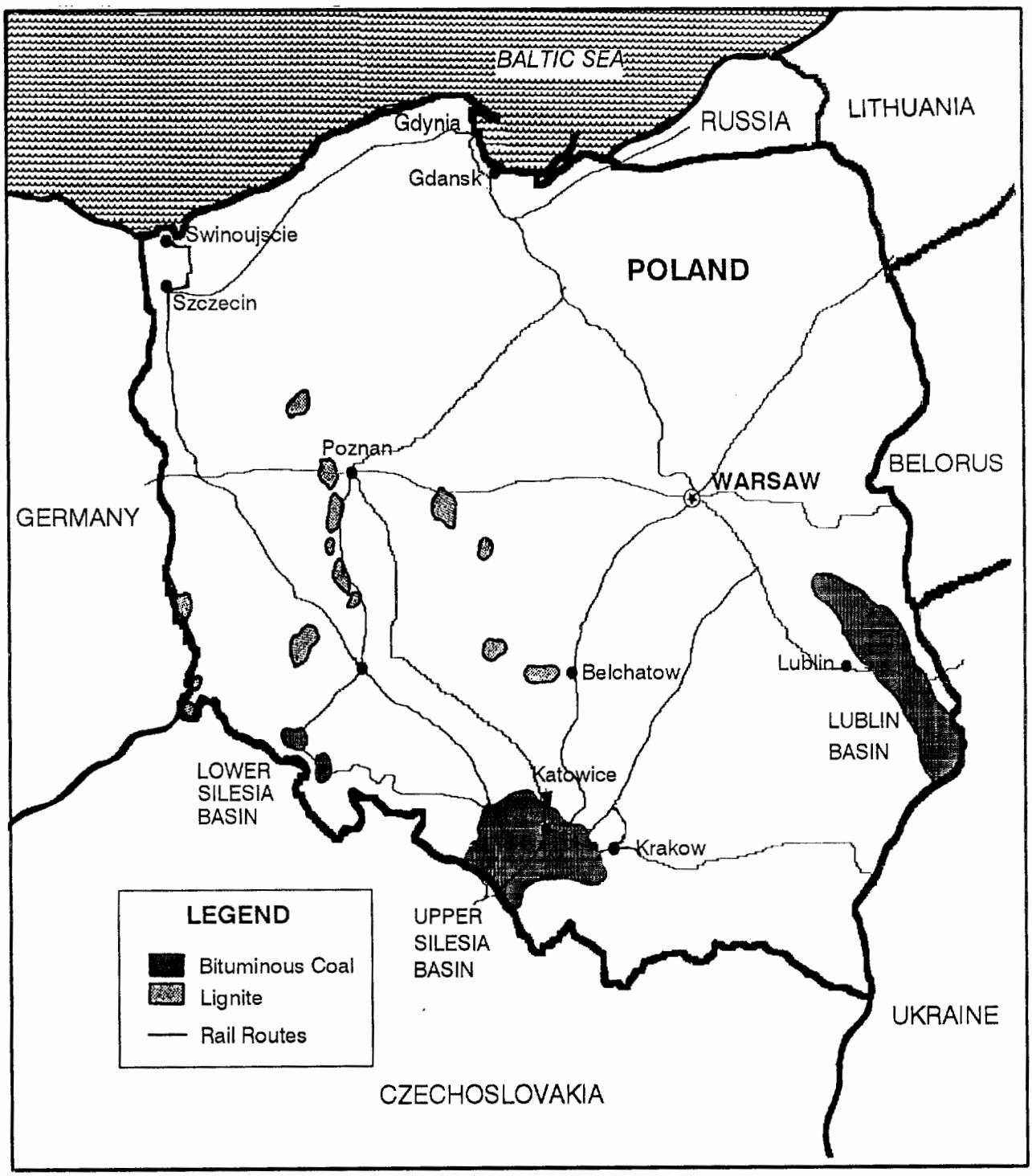

TABLE C.4
Polish Oceangoing Exports of Coal and Coke
by Port of Exit, 1989
(thousand metric tons)

Port	Coal	Coke	Total
Gdynia	1,430	549	1,979
Gdansk BAZ	835	2	837
Port Polnocny (Gdansk North Port)	6,429	-	6,429
Szczecin	1,607	3	1,610
Swinoujscie	4,449	-	4,449
TOTAL	14,750	554	15,304

Source: "Polish Exports of Fossil Fuels in 1989 in the Light of the International Coal Market Position," Polish Coal Review, Weglokoks, Volume 45, No. 1 (268), 1990.

The most important port for coal exporting is Port Polnocny (Gdansk North Port). Its design capacity is 8.5 Mmt/year and is capable of handling 170,000 deadweight ton (dwt) vessels.

Swinoujscie, which translates as the "pig port," is the next largest coal exporting facility, with a stated annual capacity of 5.6 Mmt/year; it is capable of handling 60,000 dwt vessels.

Annual capacity of existing port facilities indicates that Polish coal exports of coal could be severely limited by port restrictions. While exports of coal via rail do not appear to be limited by transport capacity, oceangoing exports do appear to be limited because only two Polish ports are capable of handling Panamax or larger vessels. Also, the loading facilities have a limited annual design capacity of approximately 14.1 Mmt. If the Polish mines hope to increase exports significantly, then investments in new loading facilities will be necessary.