SPECIAL PUBLICATION 12-94

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

U. S. DEPARTMENT OF THE INTERIOR

U.S. BUREAU OF MINES

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

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April 1994

Library of Congress Cataloging-in-Publication Data:

Sherer, Erik
A cost comparison of selected U.S. and Indonesian coal mines / prepared by Erik Sherer.
p. cm.
"April 1994."
1. Coal mines and mining--Indonesia--Costs.
2. Coal mines and mining--United States--Costs.
I. United States. Minerals Availability Field Office. II. Title.
HD9556.I52S53 1994
338.2'34'09598--dc20 94-17345
CIP

FOREWORD

This report was prepared by the Division of Resource Evaluation, U.S. Bureau of Mines, Department of the Interior at the request of the Office of Energy, International Trade Administration, Department of Commerce.

The study is the seventh of a series of 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 is given to P.T. Tambang Batubara Bukit Asam and the Indonesian and U.S. coal mining companies that participated in this study. This study would not have been possible without the cooperation of these parties.

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EXECUTIVE SUMMARY

Indonesia is poised to become a major player in the Pacific Rim thermal coal markets. Although the colonial Dutch developed numerous coal mines in the late 1800's for steamship bunkers and domestic fuel, Indonesia's coal industry has only recently begun to actively participate in the growing global marketplace. This export coal is primarily the result of the commercial development of coal mines in eastern Kalimantan by foreign contractors. From virtually no coal exports in the late 1980's, Indonesia's coal industry has increased its exports to approximately 15 million metric tons (Mmt) in 1992. In 1992, Indonesia was the world's sixth largest exporter of steam coal. By the year 2000, Indonesia projects that it will supply approximately 25 percent of the seaborne thermal coal requirements of the Pacific Rim countries. Although limited quantities of this coal may enter the European and U.S. markets, high qualities, low production costs, and favorable transportation rates will make Indonesian coals very competitive in the rapidly growing Pacific Rim markets.

This study examines the Indonesian coal mining industry and compares it to the U.S. coal mining industry. This report is the sixth in a series of coal exporting country studies requested by the House Appropriations Committee. Previous studies examined the Colombian, Canadian, Australian, South African, Polish, and Venezuelan coal industries.

This study examines the basic cost of mining coal in Indonesia and the United States through case studies of comparable mines in both countries. Unit component costs that make up the basic mining cost were analyzed to identify differences in cost structures. These unit component costs include labor, materials and supplies, land, taxes, capital, and compliance with applicable health, safety, and environmental regulations.

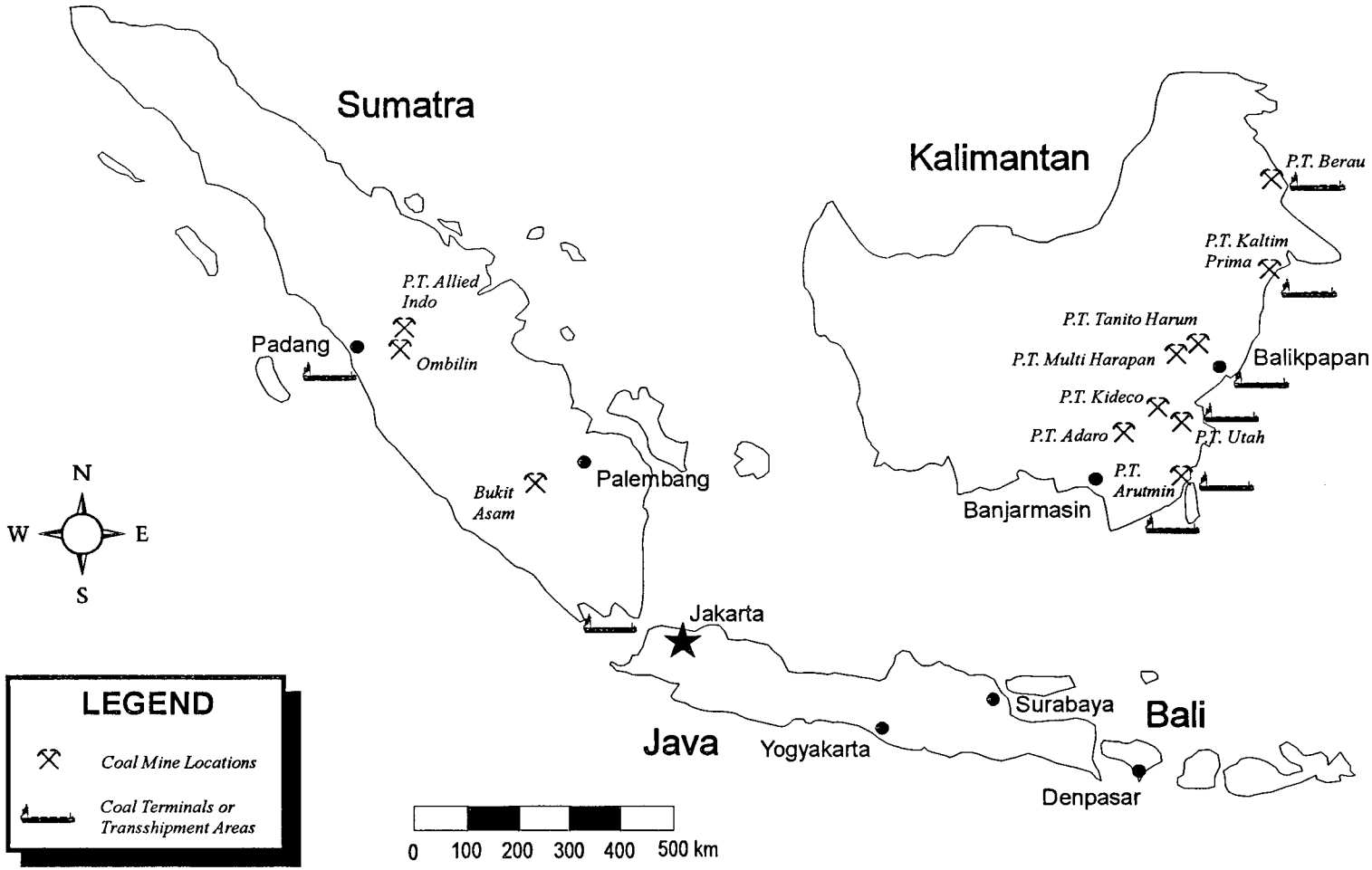
This study also includes a limited analysis of the relative market competitiveness between selected Indonesian and U.S. coal mines. Thermal coal markets that are examined include the U.S. Mississippi River, Europe, and Japan.

Indonesian Coal Industry

Coal is produced in Indonesia by the government, cooperative coal contractors, and by private companies. Almost all export coal is produced by the coal contractors. These coal contractors are privately owned, limited-liability companies that have long-term, contractual agreements with the Indonesian Government to exploit specific coal reserves in return for the payment of a royalty-in-kind (coal tonnage). These production sharing contracts are administered by P.T. Tambang Batubara Bukit Asam (PTTBBA), the Indonesian coal mining agency. Nine of these coal contractors are in Kalimantan and one contractor is in western Sumatra (see Figure I). In addition to the 10 coal contractors, there are

Figure I

Indonesian Coal Mine Locations



about 20 small private companies that produce limited tonnages. Indonesia recently announced that it had awarded 20 additional coal concessions to domestic entities.

Indonesia currently accounts for less than 1 percent of world coal production, while the United States produces about 18 percent. In 1992, Indonesian salable coal production was 22.4 Mmt, while United States salable production was 907 Mmt. Indonesia ranks 20th in world coal production, while the United States ranks 2nd. Almost all the coal mined in Indonesia is by surface methods, and approximately 40 percent is mined by underground methods in the United States.

Indonesian coal production in 1992 was valued at approximately $0.6 billion, and employment in the industry was about 15,000. U.S. production in 1992 was valued at more than $21 billion, and the industry employed about 110,000 people.

The Indonesian coal industry is regulated by the Central Government, while the U.S. coal industry is extensively regulated by Federal and State Governments. In Indonesia, all coal resources are owned by the Government. In the eastern United States, most coal deposits are privately owned, and most western U.S. coal is owned by the Federal Government.

Almost all of Indonesia's exported coal is produced at large surface mines. The mining equipment used in these operations is generally smaller than is currently employed in the United States and Australia. Indonesian coal mines tend to employ more unskilled and semiskilled workers than is typical in the United States.

The Indonesian coals that are currently being exploited are primarily thermal coals with low ash and low sulfur values. High volatile, bituminous B and C rank coals are the primary products being developed for export, while subbituminous and lignitic coals are being developed for local markets. Some of Indonesia's coals have extremely low ash and sulfur levels that are advantageous in the growing clean air markets. Indonesian coals are also entering the metallurgical markets in the Pacific Rim as pulverized coal injection products.

Indonesia exports approximately 70 percent of its salable coal production, and the United States exports less than 10 percent of its salable production. Most of Indonesia's coal exports are for thermal use compared to 60 percent metallurgical coal exports from the United States. About 20 percent of Indonesia's coal production is used by the national electrical utility, Perusahaan Umum Listrik Negara (PLN). Most of PLN's coal requirements are met by the Government-owned and -operated (PTTBBA) mines on Sumatra.

The primary markets for Indonesia's export coal are the Pacific Rim countries of Japan, Hong Kong, Malaysia, and Taiwan. Thermal powerplants and cement kilns burn most of this coal. Recently,

Indonesia's higher rank coals have been used for pulverized coal injection at Japanese steel works. Minor tonnages of Indonesian coals have been shipped to Europe and the United States.

Basic Mining Costs

The inherent differences in the basic cost of mining a metric ton of coal in Indonesia and in the United States were examined through case studies of comparable mines. These differences in basic mining costs include variations in mining conditions, labor productivity, wages, benefits, costs of supplies, capital costs, managerial efficiency, taxes, royalties, and governmental regulations. To identify these specific cost differences; mines with similar geologic conditions, mining methods, and production capacities were examined. Two cases were developed: Case I examines large, flat-lying surface coal mines and Case II examines large, steeply dipping surface coal mines.

The findings from Case I show that basic mining costs for flat-lying coal mines are lower in the United States than in Indonesia. Case II shows that the basic mining costs for steeply dipping surface mines in Indonesia are lower than in the United States.

In Case I, the U.S. flat-lying surface mines have a mine-mouth cost advantage that ranges from $3.41 to $5.47 per metric ton at a zero percent discounted cash-flow rate of return (DCFROR) to $4.55 to $5.55 per metric ton at a 15 percent DCFROR. In Case II, the Indonesian steeply dipping surface mines have a mine-mouth cost advantage that ranges from $7.97 to $8.74 per metric ton at a zero percent DCFROR to $10.46 to $16.98 per metric ton at a 15 percent DCFROR.

The main cost advantages of the U.S. flat-lying surface mines are lower stripping ratios and greater economies of scale. Lower labor costs in Indonesia are countered by higher labor productivity at the U.S. mines. Lower operating and land costs at the flat-lying U.S. surface mines are offset by higher tax costs. Capital costs do not appear significantly different at these mines.

The primary cost advantages of the Indonesian steeply dipping surface mines are less complex mining conditions and greater economies of scale. Indonesian steeply dipping mines show lower operating, land, and tax costs than U.S. mines. The steeply dipping U.S. coal mines are marginal competitors in the domestic market or serve captive markets. Four to twelve coal seams are mined at these U.S. mines versus the single-seam Indonesian operations. In the United States, the mining of steeply dipping coal seams is relatively rare.

Land costs at the Indonesian coal mines are slightly higher than those paid by the U.S. mines on a percentage basis. The Indonesian mines pay 13.5 percent of their product (royalty-in-kind) to the Indonesian Government. Most of the coal extracted at the U.S. mines included in this study is owned by the Federal Government and is subject to a 12.5 percent royalty based on gross revenues (f.o.b. mine). Although the Indonesian royalty is paid with product and the U.S. royalty is paid in dollars, the net impacts of these royalties are equivalent (gross revenue is the product of tonnage and price per ton).

Tax costs for the U.S. mines are considerably higher than those for the Indonesian mines. The tax charges that account for most of the differences are production taxes: black lung tax, abandoned mine land reclamation fee, and State severance taxes.

In general, the Indonesian mines have lower regulatory compliance costs because of the absence of a black lung (pneumoconiosis) tax and no abandoned mine lands fee. Both of these U.S. regulatory costs are primarily intended to compensate or rectify past problems (coal miners with black lung disease or abandoned, unreclaimed mine land). Because of Indonesia's historically low levels of coal production, neither of these issues is a significant problem. Compliance costs for the U.S. mines are $0.35 to $1.10 per metric ton higher than for the Indonesian mines.

Delivered Costs

The Indonesian coal mines included in this study are extremely competitive in Pacific Rim thermal markets. This coal is also competitive in European thermal markets but is not competitive in U.S. Mississippi River thermal markets. Indonesian thermal coal exports will continue to grow at a rapid rate during the remainder of the 1990's as existing projects increase production and as new projects are brought on-stream. This continued growth will be driven by strong demand growth in Pacific Rim thermal coal markets and by the competitive advantages of Indonesia's coal suppliers.

Indonesian coals will continue to capture market share from Australia and South Africa in Pacific Rim markets and could take market share from Australia, South Africa, and the United States in European markets. Indonesian coals with extremely low sulfur levels may find niche environmental markets in the United States. Indonesia's low-ash, low-sulfur bituminous coals will continue to penetrate the pulverized coal injection (PCI) markets of the Pacific Rim. These coals will directly compete with PCI coals from Australia and South Africa and could displace coking coals from Australia and the United States.

The delivered costs of low-sulfur, subbituminous coals to a generating plant on the Mississippi River for select U.S. and Indonesian mines were examined in Case III. Delivered costs

range from $34.69 to $49.11 for the Indonesian coal mines and from $20.09 to $40.31 per metric ton for the U.S. mines. The delivered costs of the U.S. coals to this market are lower than the Indonesian coals. This competitive advantage is primarily due to the extremely low mine-mouth costs of the large U.S. mines in the Powder River Basin and the high freight rates incurred by the Indonesian coals. However, there may be niche opportunities for the extremely low sulfur coals of Indonesia. These extremely low sulfur levels may allow a generating plant to meet the 1990 U.S. Clean Air Act Amendments emission requirements by blending high-sulfur, midwestern coals with the Indonesian coal.

The delivered costs for the U.S. and Indonesian coal in European thermal markets were examined in Case IV. Delivered costs range from $34.44 to $50.62 per metric ton for the Indonesian coal mines and from $44.02 to $65.71 per metric ton for the U.S. mines. The delivered costs of Indonesian coals to this market are lower than U.S. coals. The Indonesian mines included in this case study show a $10 to $15 delivered cost advantage over the U.S. mines in the European thermal market. This competitive advantage is due to lower mine-mouth costs and lower inland freight costs for the Indonesian mines.

The delivered costs for the U.S. and Indonesian coal in Japanese thermal markets were examined in Case V. Delivered costs range from $29.94 to $44.62 per metric ton for the Indonesian coal mines and from $37.87 to $58.07 per metric ton for the U.S. mines. The delivered costs of Indonesian coals to this market are lower than U.S. coals. The Indonesian mines included in this case study show an $8 to $13 delivered cost advantage over the U.S. mines in the Japanese thermal market. This competitive advantage is primarily due to lower inland and ocean freight costs for the Indonesian mines.

CHAPTER 1

INTRODUCTION

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

This report compares the basic costs of mining coal at comparable Indonesian and U.S. mines. Basic mining cost is defined as the average cost of producing one metric ton of raw coal over the life of the mine.[2] Unit component costs that make up the basic mining cost were analyzed to identify differences in cost structures. Unit component costs are labor, materials and supplies, land, taxes, capital, and compliance with applicable health, safety, and environmental regulations.

This report also includes a limited analysis of the relative market competitiveness between selected Indonesian and U.S. coal mines. Thermal coal markets are examined in the U.S. Mississippi River area, Europe, and Japan.

Indonesia is emerging as a major supplier of thermal coal to Pacific Rim markets. From virtually no coal exports in the late 1980's, Indonesia's coal industry has increased its exports to approximately 15 Mmt in 1992. In 1992, Indonesia was the world's sixth largest exporter of thermal coal.

Study Approach

As in previous country coal studies, comparative case analyses are used. Each case compares the costs of selected Indonesian and U.S. mines. There are two cases analyzing the basic costs of extracting coal by different mining methods. Case I compares surface mines with flat-lying coal seams. Case II analyzes large surface mines with steeply dipping coal seams.

Cases III, IV, and V analyze the delivered cost competitiveness (basic mining costs plus preparation and transportation costs) of

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

[2]Metric tons (2204.6 pounds) are used throughout this report unless noted otherwise. The abbreviation mt will be used to represent 1 metric ton and Mmt will represent 1 million metric tons.

selected Indonesian and U.S. mines. Thermal coal markets are examined in the U.S. Mississippi River area, Europe, and Japan.

Methodology

The methodology for calculating the average basic mining cost over the life of the mine is similar to that employed in the previous studies.[3] Chapter 3 has a brief explanation of the engineering cost estimation procedures and the discounted cash-flow analysis methods that were used to calculate the average basic mining cost.

Scope of Study

The seven Indonesian mines in this study are on Kalimantan and are owned and operated by contractors to P.T. Tambang Batubara Bukit Asam, the Indonesian coal mining agency. These mines export high-quality bituminous or subbituminous thermal coals. The U.S. mines in this study are in the Appalachian and Western coal producing regions. Most of these mines were developed to supply domestic markets.

In this study, mine cost data are aggregated to protect the confidentiality of cost information. Individual mines are not identified in the cost analyses, and proprietary data are not listed. Regulations of the U.S. Bureau of Mines require this protection of proprietary data.

The Indonesian mines in this study are as follows:

- Four surface coal mines that produced 1 to 7 Mmt each in 1992 from relatively flat-lying coal seams. Planned production capacities for some of these mines exceed 12 million metric tons per year (Mmt/yr) in the 1990's.

- Three surface coal mines that produced 1 to 3 Mmt/yr each from steeply dipping coal seams (dips greater than 15 percent) in 1992. These operations use shovels and trucks to mine one coal seam. The planned production capacities from some of these mines approach 20 Mmt/yr by the late 1990's.

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[3]For Example: 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 Interior, U.S. Bureau of Mines, April 1990.

The U.S. mines in this study are as follows:

- Four large surface coal mines that produce 2 to 13 Mmt/yr from flat-lying coal seams. These mines use draglines or trucks and shovels for overburden removal. These mines are in Kentucky and Wyoming.

- Four surface coal mines that produce 0.3 to 4.0 Mmt/yr each from steeply dipping coal seams. These mines use trucks and shovels for overburden removal and coal mining. These mines are in the States of New Mexico, Washington and Wyoming.

- Two underground coal mines that use longwalls and/or continuous miners to produce 2 to 4 Mmt/yr each. These mines are in Alabama and Kentucky.

Caution should be used in comparing the basic mining and costs in this report to specific market transactions. Mining costs in this study are averages over the expected life of a mine and may not reflect the actual cost at a specific time. Transportation rates are extremely volatile and can have a significant impact on the delivered cost of coal.

The engineering cost evaluations in this study are based on mine operating conditions in late 1992. The December 1992 exchange rate of 2,055 rupiah (Rp) per U.S.$1.00 was used to covert all costs to U.S. dollars. Any increase or decrease in this exchange rate would affect the apparent cost of mining in Indonesia when expressed in U.S. dollars. All costs--including individual mine-mouth costs and transport costs--are in December 1992 U.S. dollars per metric ton.

Organization of Report

Chapter 2 is an overview of Indonesia and the Indonesian coal mining industry. Chapter 3 compares the basic costs of extracting raw coal by surface mining methods. Chapter 4 examines the competitiveness of selected mines in specific world markets.

This study has four appendices. Appendices A and B are detailed descriptions of the applicable Federal and State tax and regulatory regimes for Indonesia and the United States. Appendix C is a detailed description of the coal producing areas in Indonesia including brief descriptions of the coal mines. Appendix C also contains brief descriptions of the U.S. mines used in this study. Appendix D is an example of a contract of work for the cooperative coal contractors in Indonesia.

CHAPTER 2

INDONESIA AND THE INDONESIAN COAL INDUSTRY

Indonesia and the Indonesian coal industry are described in this chapter. Indonesia's role in world coal production and trade is characterized, and its relative economic importance, size, and structure as compared with the U.S. coal industry are discussed. Appendix C provides additional details on Indonesia's coal industry and the coal mines examined in this study.

Coal is produced in Indonesia by the Government, cooperative coal contractors, and by private companies. Almost all of the export coal is produced by the coal contractors. These coal contractors are privately owned, limited-liability companies (Perseroan Terbatas) that have long-term, contractual agreements with the Indonesian Government to exploit specific coal reserves in return for the payment of a royalty-in-kind (coal tonnage). These production sharing contracts are administered by P.T. Tambang Batubara Bukit Asam (PTTBBA), the Indonesian coal mining agency. Nine of these coal contractors are on Kalimantan, and one contractor is in western Sumatra. In addition to the 10 coal contractors, there are about 20 small private companies (Kuasa Pertambangan) that produce limited tonnages.

Indonesia

The Republic of Indonesia is in Southeast Asia on an archipelago of more than 13,000 islands. Indonesia is slightly larger than the State of Alaska with 90 percent of the land mass occurring on five islands: Kalimantan (Borneo), Sumatra, Irian Jaya, Sulawesi, and Java. These islands stretch across an area that is roughly the size of the continental U.S. Jakarta, in west Java, is the capital of Indonesia and its largest city.

Indonesia has a population of approximately 186 million, the fifth largest in the world. Indonesia is a newly industrialized economy with an average, annual, per capita gross domestic product (GDP) in 1992 of U.S.$675 (1992 U.S. GDP was $2,355 per capita). Principal industries include agriculture, petroleum, timber, textiles, rubber, and minerals. Indonesia is a net exporting country with resources and raw materials as primary exports and machinery, durables, and chemicals as primary imports. As a result of a series of deregulation efforts, exports of light industrial and manufactured goods are rapidly increasing. Indonesia's primary trading partner is Japan along with the European Community, the United States, and Singapore.

On the equator between the Indian and Pacific oceans, Indonesia has a humid, tropical climate with monsoon rainfall from December to March. Average coastal temperatures range from 24-32°C with average annual rainfalls of 2-5 meters (m). The topography of

Indonesia varies from the swampy lowlands of eastern Sumatra and southern Kalimantan to towering peaks in Irian Jaya, Java, and Sulawesi. Because the Indonesian archipelago is at the intersections of the Australian and Eurasian continental plates and the Philippine and Indian Ocean plates, there are a wide variety of tectonic and morphological features throughout the islands including numerous active volcanoes. Indonesian vegetation ranges from sub-alpine tundra to tropical rain forests. Although the majority of the islands were originally covered with tropical rain forests, extensive slash-and-burn cultivation and timbering have resulted in large open crop areas or secondary jungle growths. Intense tropical rainfall and leaching have rendered many of Indonesia's soils relatively infertile. Active volcanism on the islands of Java, Sumatra, and the adjacent islands has resulted in increased soil fertility, extensive agricultural development, and high population densities.

Indonesia has one of the most diverse populations in the world with more that 300 distinct ethnic groups. The most prominent ethnic groups are Javanese and Sundanese with various other Oceanic/Asiatic groups composing the remainder. The official language is Bahasa Indonesian (a form of Malay), which is usually spoken in addition to more than 200 local dialects. English, Chinese, and Japanese are also spoken by many in the business community. Although 90 percent of the population is Muslim, Indonesia is not an Islamic State. Indonesia encourages religious and cultural diversity through its official *Pancasila* philosophy. Indonesia has a developing educational system with an average adult literacy rate of approximately 75 percent. Indonesia has more that 50 universities that supply an increasingly educated labor force.

Economy

During its brief national history, Indonesia has faced and successfully overcome several serious economic threats. Prior to 1967, the economy was stagnant, there were no foreign exchange reserves, and hyperinflation was rampant. Since then, inflation has been controlled, foreign exchange reserves have been developed, and Indonesia has cultivated an increasingly market-oriented economy. Indonesia's developing oil industry drove annual GDP growth of approximately 8 percent during the energy shortage years of the 1970's. The worldwide recession and decline in oil prices during the early 1980's resulted in GDP growth of only 2.3 percent in 1982. As a result of lower energy

prices, Indonesia began to emphasize non-oil exports and has achieved impressive GDP growth during the 1980's.

Indonesia's economic strengths include the following:

- A large and growing labor force.
- Abundant natural resources and productive agriculture.
- Stable government that encourages business and commerce.
- Numerous deepwater seaports on major marine routes.

Indonesia's economic weaknesses include the following:

- Limited infrastructure (roads, communications, electricity and utilities).
- Limited domestic capital formation (excellent record of foreign capital formation).
- Limited domestic manufacturing industry.

Indonesia's currency is the rupiah (Rp). The rupiah is thinly traded and has a quasi-floating exchange rate. During the oil dominated economy of the 1970's, Indonesia had a relatively flat exchange rate. Falling oil prices and a weakening of Indonesia's economy in the 1980's led to two successive 30 percent (dollar denominated) devaluations of the rupiah. With a recent annual inflation rate of approximately 7 percent to 9 percent, Indonesia has had to allow its currency to decline on a regular basis to maintain parity with global currency standards. The exchange rate used in this study is Rp 2,055 per U.S.$1.00 and corresponds to the mid-December 1992, exchange rate (see Figure 2.1).

Coal Industry

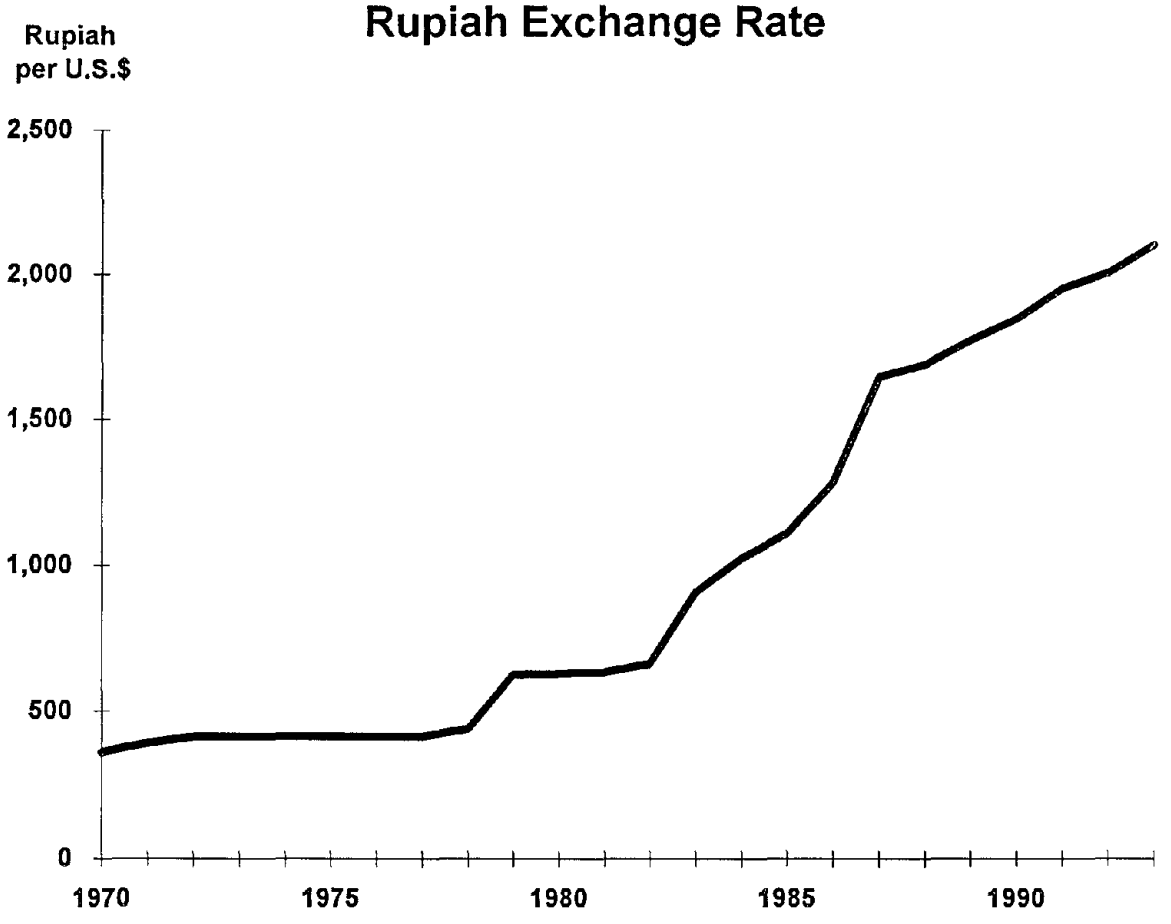
Indonesia accounts for less than 1 percent of world coal production, while the United States produces about 18 percent.[4] In 1992, Indonesian coal production was 22.4 Mmt, while U.S. production was 907 Mmt. Indonesia ranks 20th in world coal production, while the United States ranks second. Almost all of the coal mined in Indonesia is by surface methods, while in the United States, approximately 60 percent is by surface methods.

Indonesian coal production in 1992 was valued at approximately U.S.$0.6 billion, and employment in the industry was about 15,000. U.S. production in 1992 was valued at more that $21 billion, and the industry employed about 110,000 people.

Indonesia exports approximately 70 percent of its coal production; the United States exports less than 10 percent of its coal production. Virtually all of Indonesia's coal exports were

[4]International Energy Outlook 1992, Energy Information Administration, March 1992.

Figure 2.1


Rupiah Exchange Rate
Rupiah per U.S.$
2,500
2,000
1,500
1,000
500
0
1970
1975
1980
1985
1990

for thermal use compared to 60 percent metallurgical coal exports from the United States. About 20 percent of Indonesia's coal production is used by the national electrical utility, Perusahaan Umum Listrik Negara (PLN). Most of PLN's coal requirements are met by the P.T. Tambang Batubara Bukit Asam (PTTBBA) mines on Sumatra. The remaining domestic coal use is primarily for firing cement kilns. The Indonesian Government is also encouraging the use of coal and coal briquettes instead of wood from Indonesia's endangered rain forests for household purposes. Approximately 86 percent of U.S. domestic coal consumption was used for electrical power generation in 1990.

Export coal prices are set in international markets. The importance of the export market to the profitability of the Indonesian coal industry is substantial. The f.o.b. value of Indonesian coal exports in 1992 was approximately $0.4 billion, which represented about 2 percent of the country's exports. U.S. coal exports were valued at $4.1 billion in 1992, and during the last 10 years have represented from 1 to 3 percent of total U.S. merchandise trade.

The Indonesian coal industry is regulated by the Central Government, while the U.S. coal industry is regulated by Federal, State, and local Governments. In Indonesia, all coal resources are owned by the Government. Most eastern U.S. coal deposits are privately owned, while most western U.S. deposits are owned by the Federal Government. Basic labor, health, safety, and environmental controls and standards are mandated by the Indonesian Central Government.

Indonesia does not report accident incident rates and fatalities for its coal mining industry. Employers are required to adopt a paternal role and are responsible for the health and well-being of employees and their families. Mine operators are required to institute safe work practices and maintain facilities to ensure the health and safety of their employees. The Safety Act of 1970 requires employers to provide basic worker protection. Mining companies are required to set up compensation schemes that provide payment to employees (or their dependents) if employees are injured or killed while working at their jobs.

Almost all of Indonesia's exported coal is produced in large surface mines. The mining equipment used in these operations is typically smaller than is currently used in the United States and Australia. Indonesian coal mines tend to employ a higher percentage of unskilled and semiskilled workers than is typical in the United States. This appears to be influenced by the lower wage rates in Indonesia and the remote locations of these mines that require larger support staffs (cooks, laundry workers, etc.). Indonesia does not currently report the labor productivity of its coal mining industry. However, as the Indonesian coal mining industry matures, there is no reason to think that it will not be as productive as competing coal exporters.

Coal Geology and Reserves

Almost all of Indonesia's coal resources are of Tertiary age. Indonesia's bituminous and subbituminous coals are of Eocene and Miocene age, and the lignites are usually of Miocene to Paleocene age. Indonesia's coals are young compared to most of the world's export coals. Coal rank in Indonesia may usually be correlated with tectonic disturbances. For example, the higher rank coals of Bukit Asam are associated with volcanic intrusions, the higher rank Senakin coals overlay a large mafic intrusion, and the higher rank coals of Tanjung Redeb are highly folded. The coals of the Sangatta area are subbituminous rank except for the higher rank coals being mined by Kaltim Prima over the Pinang Dome (a diapiric dome). Most of Indonesia's coals have low sulfur levels and low ash levels.

Although coal deposits are found in sedimentary basins throughout Indonesia, known, economically extractable reserves are currently limited to the islands of Sumatra and Kalimantan. Indonesia's currently known coal resources and reserves are shown in Table 2.1. Of these coal resources, approximately 14 percent are of bituminous rank, 19 percent are of subbituminous rank and 67 percent are lignites.[5]

Indonesia currently estimates that its coal resources are 34.2 billion mt.[6] These resource numbers may understate Indonesia's true coal potential, particularly on Kalimantan and Indonesia's eastern islands. Some of these areas have had little systematic exploration, and the reported resources only reflect a limited knowledge of these coalfields. In many cases, coal exploration has been limited to areas adjacent to tidewater or rivers.

Although most of Indonesia's current coal mining operations are surface mines, Indonesia has large reserves of underground minable coals. Surface mines are currently dominant because of the existence of undeveloped reserves, low development costs, and limited underground mining technology in Indonesia. Reported coal thicknesses range from less than 0.3 m to seams of more that 70 m. Typical minable seam thicknesses are 3 to 15 m with average stripping ratios of 3 to 6 bank cubic meters per metric ton of coal (BCM/mt). Many of the lower rank coal deposits are very thick. Large deposits of lower rank coals have been delineated that have low stripping ratios.

Currently active mines range from single-seam operations to operations of more that ten coal seams. Seam dips vary from flat to almost vertical. Because of the coal rank/structural disturbance relationship that was previously mentioned, many

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[5]Coal and Its Prospects in Indonesia. P.T. Batubara, Jakarta, 1988.

[6]Mangunwidjaya, Ambyo. The Roles of Coal in the Development of Indonesia. P.T. Tambang Batubara Bukit Asam, 1992.

TABLE 2.1

INDONESIAN COAL RESERVES

(IN SITU Mmt)

Location	Measured	Indicated and Inferred	Hypothetical	Total
Sumatra	2,888	13,445	8,343	24,676
Kalimantan	1,840	5,214	2,307	9,361
Java	12	29	20	61
Sulawesi	5	19	0	24
West Irian Jaya	0	83	0	83
Total	4,745	18,790	10,670	34,205

Source: P.T. Batubara Bukit Asam, February 1992.

current mines are in faulted and geologically complex areas. Since the current coal mining activity is concentrated in the higher rank deposits that are associated with geologic disturbances, many of the current mines are in dipping strata. Overburdens range from partially consolidated sands and clays to highly indurated sandstones and shales. Igneous rocks (both intrusive and/or extrusive) are present in the overburdens of several of the coal deposits.

In most cases, the coal seams are relatively free from partings and other sources of contamination. Some Indonesian coal seams contain thin partings of volcanic ash that contribute to the unusual ash chemistries that are seen in a few Indonesian coals. Top and bottom contacts are usually distinct and easily separated. Closely spaced minor faulting has been reported in some of the more geologically disturbed areas.

Coal Quality and Utilization

The Indonesian coals that are currently being developed are primarily steaming coals with low ash and low sulfur values. High volatile, bituminous B and C rank coals are the primary products being developed for export, while subbituminous and lignitic coals are being developed for local markets. Although anthracite and high-volatile bituminous A coals have been mined on a limited basis in Indonesia, they are relatively rare and are usually associated with igneous intrusives.

The majority of the current Indonesian coal projects will produce a 5,500 to 6,500 thousand calories per kilogram (kcal/kg) steaming coal product that should be compatible with most boilers in the Pacific Rim. Low ash levels in many of Indonesia's coal products are attributable to low inherent ash levels and the minimal dilution associated with mining thick coal seams. Ash fusion temperatures appear to be uniformly high for these products, and sulfur values are uniformly low. Ash values vary from low to moderate for run-of-mine thermal coals. Arutmin's Senakin product has a low Hardgrove grindability index but appears to have achieved a good market acceptance.

Indonesia's lower rank coals (Kideco, Berau, and Adaro) are reported to perform well in the more recently built Pacific Rim boilers. These lower rank coals compete well with the Blair Athol type coals from Australia. Because of extremely low sulfur values, P.T. Adaro is aggressively marketing its product in the growing clean-air markets. P.T. Berau's product has low ash fusion temperatures, but should be acceptable in modern boilers that have wider tube spacings and convection runs.

Almost all of Indonesia's coals have ash chemistries that are more lignitic (alkaline) that normal for higher rank coals. This ash chemistry is moderated by the extremely low ash levels in many of the coals. The subbituminous coals and lignites are characterized by very thick seams and extremely low ash and

sulfur levels. Indonesia's lower rank/high moisture coals do not appear to be highly reactive. No significant problems with spontaneous combustion and self-heating have been reported.

Industry Structure

All coal mining in Indonesia is under the control of Perseroan Terbatas Tambang Batubara Bukit Asam (PTTBBA), the State coal mining agency. PTTBBA owns and operates the Ombilin and Bukit Asam coal mining complexes on Sumatra. There are 10 cooperative coal contractors that operate under contracts of work awarded in the early 1980's. Nine of these contractors were producing commercial quantities of coal in 1993. A second round of coal contracts was awarded to 19 domestic companies in December 1993.

The contract of work (COW) between PTTBBA and the coal concessionaires is a broad instrument that defines the rights, obligations, term, taxation, labor regulations, and many other facets of developing and operating coal mines in Indonesia. Although each COW contains different specifics as the result of individual negotiation between PTTBBA and the concessionaires, there are some common themes. As noted in Appendix A, the pre-1984 COWs have more favorable tax treatments. An example COW is shown in Appendix D. These COWs are sometimes referred to as cooperative coal contracts or production sharing agreements.

The term of the COW is for 30 years after the start of commercial production, divided into six stages of work:

1. General Survey (up to 12 months with a 12 month extension).
2. Exploration (up to 36 months with a 24 month extension).
3. Evaluation (up to 12 months).
4. Trial Operation/Test Burns (up to 6 months).
5. Construction (up to 36 months).
6. Operation (up to 30 years).

Thus, each concession should be in commercial operation within 8-12 years after it is awarded. The long exploration periods were necessary because of the large size of the tracts; the virtual absence of geologic information on many of the tracts; and the difficulties of exploration in remote, undeveloped areas. Each coal contractor had to relinquish control of more that one-half of the original concession area at the end of the exploration period. Subsequent reductions to 25 percent of the original area are required by the time of commercial operation. The contractors may designate these areas to be relinquished. The COWs also stipulate that copies of all exploration data, coal analyses, maps, designs, and evaluations must be furnished to PTTBBA.

Each coal contractor must form an Indonesian corporation that has full responsibilities and accepts all risks associated with the project development. All plans must be approved by PTTBBA. The

contractor shall provide all financing for the project. A minimum of 40 percent equity must be invested in the project. All mining equipment may be imported free of duties, but this equipment becomes the property of PTTBBA when landed at the Indonesian port of import or when purchased locally (modified by Presidential Decree number 21 of 1993 for new coal contractors). PTTBBA will receive a royalty of 13.5 percent of the coal produced either in payment (gross) or in kind (to be determined by PTTBBA on an annual basis). The royalty tonnage is transferred to PTTBBA on an f.o.b. basis in vessels provided by PTTBBA. Contractors are exempt from export duties. Contractors are granted the right to transfer funds into or out of Indonesia, in any currency, and maintain off-shore accounts for the funds associated with the project development and operation.

All COWs require the contractor sell 51 percent of the shares in the operation to Indonesian nationals or entities by the end of the first 10 years of commercial operation. Some COWs specify Indonesian participation of 25 percent by the end of year five. If no acceptable Indonesian investors are found, the project shares are to be transferred to PTTBBA at a price to be determined on the Jakarta stock exchange. The Jakarta stock exchange is small, volatile, and has been historically risky. This introduces an extra measure of financial and managerial project risk that must be incorporated in any concession evaluation.

In addition to the 10 private coal contractors, PTTBBA has awarded approximately 20 small-scale coal development rights, Kuasa Pertambangan (KP), to private Indonesian companies and small village cooperatives. Most of the production from these KPs comes from along the Mahakam River in East Kalimantan and the Bengkulu Province in Southwest Sumatra. PTTBBA estimates total production from the KPs to be less than 3 Mmt/yr in the mid-1990's. In December 1993, PTTBBA announced that it had awarded 20 additional coal blocks to domestic firms.

Domestic Coal Use

Indonesia currently derives approximately 5 percent of its primary energy supply from coal.[7] Approximately 90 percent of Indonesia's primary energy requirements are obtained from domestically produced oil and natural gas. The remainder of Indonesia's energy requirements are derived from hydroelectric installations, geothermal systems, and wood. The United States relies on coal to supply about 21 percent of its primary energy requirements. Of the 22 Mmt of coal produced in Indonesia in 1992, approximately 7 Mmt was consumed domestically. PLN, the State electrical utility, is the largest domestic consumer of coal. PLN burned 4.7 Mmt of coal in 1992. The domestic cement

[7] 1991 International Energy Annual, Energy Information Administration, U.S. Department of Energy, 1992.

industry consumed 2.1 Mmt of coal in 1992. Other industrial users accounted for 0.2 Mmt of consumption in 1992.

PLN's Suralaya power station in West Java (4 x 400 MW) consumes approximately 4.6 Mmt of coal per year. This coal is supplied by the Bukit Asam Mine on Sumatra. Three additional 600-MW units (Suralaya 5,6, and 7) are planned for construction in the late 1990's. These units will require an additional 6 Mmt of coal per year that could be supplied by an expansion of Bukit Asam and/or the Kalimantan coal contractors. The Paiton power station in east Java (2 x 400 MW) is currently under construction. Paiton has already contracted with P.T. Adaro (2.85 Mmt/yr), P.T. Berau (0.9 Mmt/yr), P.T. Kilisuci (0.9 Mmt/yr), and P.T. Arutmin (0.8 Mmt/yr) for its coal supply.[8]

Additional generating capacity is currently being evaluated at Paiton. This and other potential coal-fired generating capacity may be filled through the private sector under a build-own-operate scheme (similar to the independent powerplants that are currently being encouraged in the United States). Plants that are being considered for tender to the private sector include Paiton (4 x 600 megawatts [MW]) in East Java; Tanjung Jati (5 x 600 MW) in Central Java; two 600-MW units in West Java; two 65-MW units at Tarahan, Sumatra; and four 45-MW units at Banjarmasin, Kalimantan.[9] PLN is currently studying the feasibility of building a (2 x 600 MW) nuclear generating plant on Java.[10] The Indonesian Government is also encouraging industrial plants that are currently using diesel generators (approximately 1,800 MW) to convert to coal-fired cogeneration units.

Because of the longer time required to construct coal-fired powerplants, large, combined-cycle gas-fired powerplants are currently being constructed to address Indonesia's critical shortage of generating capacity. Two plants that are currently under construction are the 500-MW Muara Karang plant near Jakarta and the 1,500-MW Gresik plant in east Java. These plants will be fueled by large, off-shore natural gasfields. Given the shorter development time, the significantly lower capital costs of these gas-fired plants and Indonesia's abundance of natural gas, some of the anticipated growth in domestic coal demand may shift to natural gas.

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[8]"Asean Coal." The Australian Coal Report. Barlow-Jonker, Ltd., Sydney, Australia, November 1992, p. 6.

[9]Arismunandar, A. The Indonesian Government's Policy on the Use of Domestic Coal for Electric Power Generation, with Special Reference to Private Power. A paper presented at the Sixth Pacific Rim Coal Conference, June 1990, Denpasar, Indonesia.

[10]Indonesian Source Book. National Development Information Office, Republic of Indonesia, 1991, p. 115.

The cement industry is the second largest domestic consumer of Indonesia's coal (approximately 2.1 Mmt in 1992). The Indonesian Government has mandated that all cement kilns must convert from oil to coal firing. This market sector is projected to use 3-4 Mmt of coal in the year 2000.

Coal Exports

Growing from 3 Mmt of exports in 1989 to more that 15 Mmt of exports in 1992, Indonesia is rapidly becoming a significant player in the world's seaborne coal trade. Indonesia is a competitive supplier of thermal and PCI coals to the Pacific Rim markets. Indonesia's historic coal production and exports are shown in Table 2.2.

Coal Transportation and Ports

Tidewater access is one of Indonesia's primary competitive strengths. All of the East Kalimantan coal concessions are near barge-navigable waterways or close to deepwater ports. Coal is typically trucked 15-70 kilometers (km) to barge loading terminals or ocean ports. Kaltim Prima utilizes a 12-km overland conveyor from the preparation plant to the Tanjung Bara Port.

The Strait of Makassar off Kalimantan's east coast is a relatively calm body of water that is navigable by capesize vessels. After beginning operations with barges transloading to geared, handysize vessels, the Kalimantan coal producers are starting to build world-class coal loading facilities for large vessels. These facilities include Kaltim Prima's Tanjung Bara deepwater terminal, the P.T. Indonesia Bulk Terminal on the south shore of Pulau Laut, and the Arutmin Terminal near Kotabaru.

Infrastructure

Eastern Kalimantan, where almost all of Indonesia's coal exports originate, is a remote, sparsely populated area that has limited existing infrastructure. There are few roads connecting population centers; much of the commerce on Kalimantan is waterborn. There are limited electric grids, limited water distribution systems, no railroads, and limited communications systems in this area. Most of the local labor force are farmers or laborers for the logging concerns. Much of the skilled labor needed by the coal contractors must be obtained from Indonesia's larger cities (Jakarta, Bandung, etc.). There are several light-duty airfields near some of the larger towns and jet-capable airfields at Balikpapan and Banjarmasin. Several of the mine developments have built their own airfields. Most of the coal contractors are using satellite-based communications systems.

TABLE 2.2
INDONESIAN COAL BALANCE
(Mmt)

Year	PRODUCTION			Imports	Domestic Consumption	Exports
	PTTBBA	Private	Total			
1984	1.1	0.5	1.6		1.0	0.6
1985	1.6	0.5	2.1		1.1	1.0
1986	1.9	0.9	2.8	1.3	3.5	0.6
1987	2.0	1.1	3.1	1.6	4.0	0.7
1988	2.7	2.2	4.9	1.4	5.6	0.7
1989	4.1	4.6	8.7		6.0	2.7
1990	4.7	6.0	10.7		6.5	4.2
1991	6.0	7.5	13.5		6.3	7.2
1992	7.2	15.2	22.4		7.0	15.4

Sources: International Coal, NCA, 1992.
Coal Year 1993, ICR.
Coal Information, OCED, 1992.
Australian Coal Report.

Because of the low population density and the lack of infrastructure, many of the coal contractors have had to develop town sites and related services. At present, most of the skilled laborers reside in single-status dormitories and commute to their families. A typical rotation schedule is 6 weeks on-site and 2 weeks offsite. Kaltim Prima has constructed a coal-fired electrical generation and distribution system. P.T. Adaro is evaluating the feasibility of a mine-mouth, coal-fired powerplant that will also service the Tanjung and Banjarmasin areas. The other coal producers are using diesel or fuel oil generation systems. Although the lack of infrastructure is a major impediment to the development of eastern Kalimantan, construction costs are low. The private Indonesian producers typically minimize the cost of housing by recruiting many of their workers from nearby villages.

Mining Laws, Taxes, and Royalties

The Indonesian coal industry is regulated by the Central Government. The Central Government owns all coal resources in Indonesia and regulates the exploration, development, and extraction of these resources. Various Governmental agencies regulate labor, health and safety, the environment, taxation, imports, exports, shipping, communications, and financial structures.

Although the Indonesian Government is a major coal producer and supplier in the domestic markets, there has been a strong push toward increased privatization of these markets. For example, negotiations for a (2 x 600 MW) powerplant at Paiton in East Java that is to be built, owned, and operated by a private consortium are at an advanced state. Domestic coal prices are unregulated in Indonesia except for shipments from the Government-owned mines on Sumatra. PTTBBA can compete for domestic tenders using coals mined at its Sumatran mines as well as royalty tonnages produced by the coal contractors.

Mining Laws and Regulations

The evolution of laws and regulations that govern mineral extraction in Indonesia are closely associated with the political and economic development of this island nation. Mining regulations in Indonesia were first promulgated in the Indische Mijnwet of 1899 by the Dutch Colonial Government. Mine safety regulations were formalized in the "Mijnbouw Politie Reglement" or Mine Safety Regulations of 1930 (State Gazette, 1930, No. 341). These mine safety regulations are still in force in Indonesia. Since Indonesia declared independence in 1945, mineral resources have been regulated by the Central Government. Article 33 of the Indonesian Constitution of 1945 specifies that the State has total sovereignty over its land and mineral resources. Law No. 37 of 1960 addressed mineral ownership,

defined coal as a mineral that was strategic to the national economy, and specified that strategic minerals could only be exploited by the state or joint ventures between state and regional Governments.

President Suharto's rise to power on March 11, 1966, and his sweeping economic and political reforms reversed the isolationist policies of Sukarno, his predecessor. Law No. 1 of 1967 authorized foreign capital investment in Indonesia under the control of an investment coordinating board, Badan Koordinasi Penenaman Modal (BKPM). Article 8 of this law specified that, "...foreign capital investment in the field of mining shall be based on a joint-venture with the Government on the basis of a working-contract...."[11]

The 1967 Basic Mining Law (Law No. 11, 1967) provides a legal framework for foreign investment in mining operations in Indonesia. This law repealed Law 37 of 1960. This law allowed the Minister of Mines to appoint any other party as a contractor and holder of a mining authorization to carry out mining operations if, on the basis of economic and technical reasons, it would be more profitable to the state if such operations were performed by a private body. The holder of a mining authorization for exploration and/or exploitation has the right of ownership over minerals mined in conformity with the mining authorization.[12] The Ministry of Mines was later granted the authority to negotiate, issue exploration permits, and execute contracts of work for the development of minerals in coordination with BKPM. Governmental Regulation No.32, 1969, listed five procedures by which mining operations may be licensed in Indonesia:

1. Ministerial Assignment to carry out mining by Governmental bodies or agencies.

2. Issuance of a mining authorization (Kuasa Pertambangan or KP) to State or private mining companies or to Indonesian individuals.

3. Contracts with foreign or domestic companies (Contract of Work or Coal Cooperation Contract).

4. Permits for People's Mining using traditional or manual mining methods on small tracts.

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[11]Indonesian Mineral Development Digest. The Indonesian Mining Association, Jakarta, 1988, p. I-60.

[12]The Law on the Basic Provisions of Mining and Its Implementing Regulations. A translation by The Ministry of Mines, Republic of Indonesia, 1975.

5. Authorization by district Government (Surat Ijin Pertambangan Daerah) for non-strategic industrial minerals (sand, gravel, etc.).

The first three licensing methods are currently employed in Indonesia's coal industry. The state-operated mines (Bukit Asam and Ombilin) are licensed by ministerial assignment. The 10 coal contractors are licensed by coal cooperation contracts. Approximately twenty small, private coal mines are licensed by mining authorizations (KPs).

In order to conserve valuable petroleum for export, a Presidential Decree was issued in 1976 to convert the electric utilities and the cement industry to coal fueling. In recognition of limited funds and technology, the Indonesian Government began to consider foreign investors as a means to accelerate the development of Indonesia's coal resources. In June 1978, P.N.T. Batubara, acting under Mining Law No. 11 of 1967 and the Foreign Capital Investment Law No. 1 of 1967, invited tenders for coal development on eight blocks in East and South Kalimantan to boost domestic coal production. In early 1981, Presidential Decree number 49 of 1981 authorized P.T. Batubara to contract with foreign and private contractors to explore and develop other potential coal resources. The first concessions were awarded to P.T. Arutmin and P.T. Utah on November 2, 1981. Ten coal concessions have been awarded since 1981, and several of the contractors have begun commercial production. In the interim period, the State-owned Ombilin mine has been expanded and the Bukit Asam project has been completed. In addition to the mining concessions and Government mines, there are approximately 20 small, private coal mines in Indonesia (KPs).

Indonesia's coal sector was closed to foreign participation in 1986 and was reopened in 1993. PTTBBA announced that it was accepting tenders on 20 coal blocks in May of 1993. In December of 1993, PTTBBA announced that these coal concessions would be awarded to 19 domestic companies.[13]

Health and Safety Regulations

Coal mining health and safety regulations are not as formalized in Indonesia as in the United States. The primary coal mining health and safety regulation in Indonesia is the "Mijnbouw Politie Reglement" or Mine Safety Regulations of 1930 (State Gazette, 1930, No. 341) that were promulgated when Indonesia was a Dutch colony. Many of these regulations are oriented to underground coal mining. Since almost all of Indonesia's coal is currently produced from surface operations, the 1930 Mine Safety Regulations have limited impact at most current coal operations.

[13]"PTTBBA Names New Coal Contractors." International Coal Report, Financial Times, London, December 13, 1993, p 338.

Indonesia is presently working on a replacement for these dated Mine Safety Regulations. In lieu of specific coal mine health and safety regulations, the Safety Act of 1970 provides standard industrial health and safety regulation.

Environmental Regulations

The Ministry of Environment administers numerous regulations for the control of pollution in Indonesia. In 1977, Mines Minister's Decree No. 4, "Preventing and Surmounting Against Disturbance and Pollution as a Result of Surface Mining," required the submittal of a reclamation plan, topsoil preservation, regrading, water control, revegetation, and environmental monitoring. This decree specifies that non-compliance will result in suspension of mining activities by the ministry. Law No. 4 of 1982 and Law No. 29 of 1985 require that every mining venture must submit to the Central Commission on Environmental Impact Analysis a formal environmental impact analysis report (ANDAL), an environmental management plan, and an environmental impact monitoring plan. In 1988, the Minister of Mining and Energy issued "Technical Guidance for the Compilation of Environmental Impact Analysis," a broad guideline that requires all mining projects to address the social and environmental impacts of proposed operations and specify the mitigation efforts that will be required to address these impacts. All of the contracts of work contain a clause that obligates the contractor to prevent pollution and to preserve natural resources.

Taxes

There are different tax regulations for each of the primary coal production entities in Indonesia, the Government mines, the cooperative coal contractors, and the private Indonesian coal mines. Since the coal contractors are the primary coal exporters (more that 80 percent of all exports in 1992), this study will concentrate on the taxes and royalties that apply to the coal contractors. These coal contractors are subject to the taxes and royalties that are enumerated in the Contract of Work Agreements. Although each COW contains different specifics as the results of individual negotiations between PTTBBA and the coal concessionaires, there are some common elements between most of the COWs, particularly in the areas of taxes and royalties. The tax and royalty regulations that are described in this section are representative of the 10 current COWs, but specific exceptions do occur. The tax treatments and royalty agreements specified in the COW are fixed for the term of the COW (typically 30 years).

The only taxes that apply to the pre-1984 coal contractors are an income tax and a fixed $100,000 per year regional development fund (property tax). The income tax rate is 35 percent of taxable income during the first 10 years of commercial production that rises to 45 percent of taxable income during the remainder

of the COW. Indonesia levies no production taxes on the coal contractors. A summary of Indonesian and U.S. taxes is shown in Table 2.3. The details of Indonesia's tax regulations that are applicable to the coal contractors are listed in Appendix A.

Royalties

The basis of the typical contract of work is a production sharing agreement whereby PTTBBA receives a portion of the concessionaire's production in exchange for the right to mine and sell the remainder. PTTBBA then brokers its share of the coal production to both foreign and domestic concerns. The typical COW stipulates that PTTBBA shall receive 13.5 percent of the coal product f.o.b. in vessels of its choice. Some COWs allow PTTBBA to choose between the actual coal tonnage and 13.5 percent of gross sales on an annual basis. The P.T. Allied Indo COW gives PTTBBA 20 percent of the coal product because of the use of Ombilin infrastructure. Some COWs include a minimal, acreage-based rental fee for the mining area in lieu of local property taxes. Compensation must be paid to any occupants of these lands that are displaced by the mining operation. This compensation is based on a schedule that addresses buildings, improvements, and crops.

TABLE 2.3
TAXES AND FEES ON COAL MINES

	Indonesia	U.S. Federal	Alabama
Income Tax	35% First 10 Years of Production, 45% Thereafter.	34%	5%
Depletion	None	8.0% of Gross	Cost Basis Only
Royalty	13.5% of Product	12.5% Surface, 8.0% Underground	NAp
Severance Tax	None	None	$0.37/mt
Gross Proceeds Tax	None	None	None
Sales/Use Tax	None	None	4.0% State
Ad Valorem Tax	None	None	None
Property Tax	$100,000 per Year	None	65 Mils State 200 Mils County
Lease Charges	None	Bonus Bid	None
Black Lung Tax	None	4.4% of Gross Lignite Excepted.	None
Abandoned Mine Lands Fee	None	$0.39/mt Surface $0.17/mt Underground	None
Permit Fees	None	None	$1,000
Reclamation Tax	None	None	None
Reclamation Bonding	None	None (State Primacy)	Minimum $10,000 Recoverable

Notes: NAp Not Applicable
Taxes and fees as of December 1, 1992.
Indonesian taxes are based on pre-1984 contracts of work.
Tax details listed in Appendices A and B.

TABLE 2.3
TAXES AND FEES ON COAL MINES
(CONTINUED)

	Kentucky	New Mexico	Wyoming	Washington
Income Tax	8.3%	7.6%	None	None
Depletion	Federal Rate	Federal Rate	None	None
Royalty	NAp	NAp	NAp	NAp
Severance Tax	4.5% Gross	$1.24-1.29/mt	8.5%	None
Gross Proceeds Tax	None	None	None	None
Sales/Use Tax	6%, Coal Exempt	5.6%	4.0%	6.5%
Ad Valorem Tax	$0.58/Acre-Inch	None	6.0%	None
Property Tax	45 Mils 53-67 Mils County	225 Mils	6.0%	1.2% $2.00/Acre
Lease Charges	None	None	None	None
Black Lung Tax	None	None	None	None
Abandoned Mine Lands Fee	None	None	None	None
Permit Fees	$1,000/year	None	None	$250/yr
Reclamation Tax	None	None	None	None
Reclamation Bonding	Minimum $10,000 Recoverable	Minimum $10,000 Recoverable	Minimum $10,000 Recoverable	Minimum $10,000 Recoverable

Notes: NAp Not Applicable
Taxes and fees as of December 1, 1992.
Indonesian taxes are based on pre-1984 contracts of work.
Tax details listed in Appendices A and B.

CHAPTER 3

BASIC MINING COST ESTIMATES

This chapter compares basic mining costs of similar Indonesian and U.S. coal mines and identifies factors that account for significant differences. Basic mining cost is defined as the total cost to extract one metric ton of raw coal and transport this coal to the mine mouth. This basic mining cost does not include overland transportation; crushing; preparation; stockpiling; and train, barge, or ship loading.

To identify the costs associated with differences in the operational, technological, social, political, and economic conditions in Indonesia and the United States, mines having similar geologic profiles, mining plans, and size are evaluated.[14] The qualities of the coals may not be comparable, since the objective is to measure raw coal production costs, not the costs of producing a metric ton of salable coal of comparable quality and value.

In this study, basic mining costs are analyzed for two surface mining conditions: flat-lying deposits and steeply dipping deposits (greater than 15 percent average seam dip). Case I is a comparison of four surface mines in Indonesia with three surface mines in Wyoming that mine thick, flat-lying coal seams. Case II compares three surface mines in Indonesia that mine thick, steeply dipping coal seams with three similar mines in the western United States.

Mining Cost Estimation

The basic mining costs computed for Cases I and II are the average costs to extract 1 metric ton of raw coal. These costs are calculated using a DCFROR analysis of all mine-related operating expenses, land, tax, and capital costs. Capital and operating costs are based on engineering estimates of the costs required to operate the mine throughout its expected life.

Figure 3.1 outlines the basic steps involved in data collection, engineering analysis, cost estimation, and financial analysis. The engineering cost estimates and financial analyses of each mine were based on mining conditions and costs in late 1992 and the relative value of the Indonesian rupiah (Rp) to the U.S.

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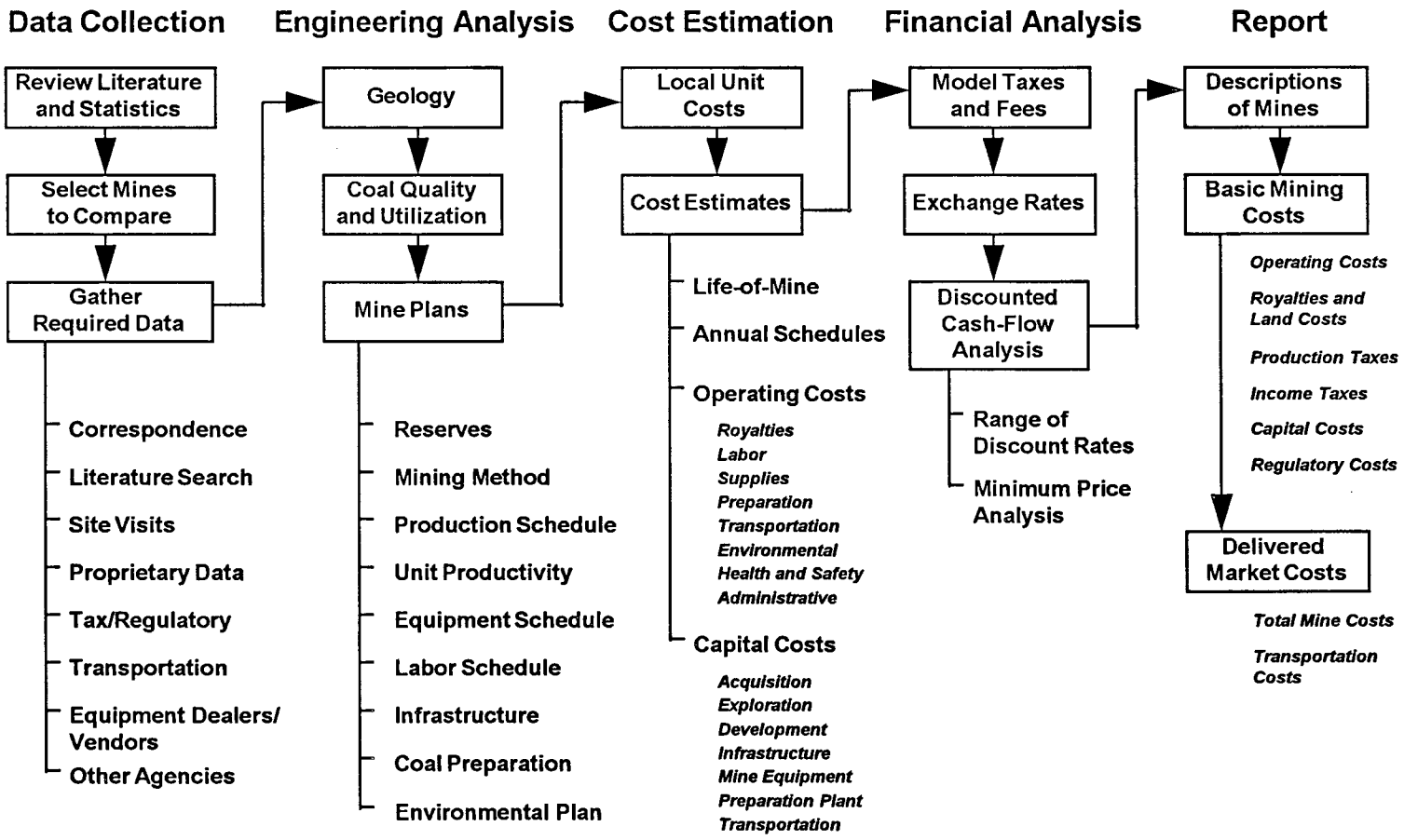
[14]For a detailed discussion on the effects geology and mine size have on mining costs, see A Cost Comparison of U.S. and Colombian Mines, U.S. Department of Commerce, International Trade Administration, and the U.S. Department of Interior, Bureau of Mines, January 1986, pp. 46-48.

Figure 3.1

Coal Competitive Analysis Process



dollar in mid-December 1992 (Rp 2,055 = U.S.$1.00). Since many of the Indonesian mines are in the early development phase, announced and/or logical capacity expansions were incorporated in these life-of-mine analyses.

The capital investments used for DCFROR analysis include all historic investments plus additional capital requirements during the remaining life of the mine. If these mines have been sold, the actual acquisition costs were used, if known, instead of historic development costs. Capital investments include surface and mineral rights acquisition, exploration, feasibility studies, mine development, mine equipment purchases, mine-site infrastructure, replacement of equipment and facilities, mine closure costs, and other fees and services normally capitalized (useful life of more than 1 year). Capital costs for overland transport, coal preparation, storage/loading, and port facilities are excluded from the basic mining cost calculation.

Mine operating costs are separated into two components: labor and materials. Labor includes wages, employee fringe benefits, and payroll-related taxes for production, maintenance, and administrative mine personnel. Materials and supplies include fuel, explosives, repair parts and consumables, electric power and utilities for mine operation, indirect costs for general and support services, general sales taxes, and insurance. Corporate overhead costs are not included in mine operating costs.

Many costs associated with compliance with mine health and safety and environmental regulations are incorporated in these capital and operating cost estimates. In this study, certain regulatory compliance costs are detailed in a separate analysis. Only mandated requirements (safety devices, reclamation, permitting and bonding, training requirements, training facilities, and special Government fees, levies and taxes) were isolated.

Land costs include expenses to acquire the use of surface land, water, mineral, and other rights needed to mine the coal. Land costs include private and Government royalties, bonus bids, lease payments, and other miscellaneous fees assessed by the Federal, State, and local governments.

Tax policies used in this study are those in effect in both countries as of December 1, 1992, and as outlined in Chapter 2, Table 2.3. Details of these taxes are listed in Appendices A and B.

Taxes are those costs paid by a mining operation to local, State and Central government authorities. Both Indonesian and U.S. coal mines are subject to corporate income taxes by their Central Governments. The contracts of work that govern the Kalimantan export coal producers specifically exempt the coal contractors from local and regional taxes except for a $100,000 per year, lump-sum payment for regional development.

Financial Analysis

The financial analyses were based on constant, December 1992, U.S. dollars. All investments are considered to be equity funded. Reinvestment capital varies according to mine size, production life, equipment life, and local maintenance practices. Working capital costs were estimated for supplies and repair parts, uncovered coal, and pit stockpiles. The timing differences of accounts payable and accounts receivable were not included in these working capital estimates.

The DCFROR methodology was used to determine the average price that is required to achieve a given rate of return during the total expected life of the mine. A DCFROR is defined as the discount rate that equates the discounted, after-tax value of operating incomes (and losses) from the mine operation to the discounted, after-tax value of all capital investments in that mine. At a zero percent return (zero percent DCFROR), all mining costs and invested capital are recovered, but there is no return on the investment (profit). At a 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-of-return was chosen merely as a point of reference (currently, a 15 percent discount rate is probably too high for most U.S. properties and could be too low for some Indonesian coal mines). Continuous discounting techniques were used in this study rather than the more common discrete discounting methods. The 15 percent continuous rate of return corresponds to a 16.18 percent discrete annual discount rate. The appropriate discount rate for each mine should address the geologic, market, and political risks associated with that investment. This discount rate should reflect the current and expected financial markets as well as the financial structure and expectations of the firm.

Mining costs for individual Indonesian and U.S. mines are not shown to avoid identifying specific mines and the disclosure of company confidential information. 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.

Although a dedicated effort was made to select mines for these basic mining cost case studies that were as similar as practical, the unique nature of many of the Indonesian mines makes exact comparisons impossible. Significant differences include mine size and stripping ratios. In all cases, the best available matches of mining methods and geology were used.

Case I: Large, Flat-Lying Surface Coal Mines

Case I examines large, flat-lying (less than 15 percent seam dip) surface mining operations in Indonesia and Wyoming. Table 3.1 summarizes mine characteristics and operating data. In these surface mines, the first operation is the removal and stockpiling and/or replacement of topsoil. Unconsolidated and weathered overburden materials are excavated without prior fragmentation. Harder overburden materials are drilled and fragmented with ANFO blasting agents and/or ripped with large tractors. Shovels, hydraulic excavators, and wheel loaders are used to load trucks for overburden movement. The tops of the coal seams are then cleaned of dilution materials with rubber-tired dozers. Thicker coal seams are then fragmented using drill and blast techniques or tractors with rippers (because of the high cost of explosives in Indonesia, many operations load the unbroken coal using hydraulic backhoes). The coal is then loaded using shovels, hydraulic excavators, and/or wheel loaders into trucks for transport out of the pit. Some of these mines in both Indonesia and the United States are currently testing and/or evaluating continuous surface miners, near- and/or in-pit crushing and conveying and overland conveying systems.

The basic mining cost ranges for Case I are shown in Table 3.2. The ranges represent the costs to extract one metric ton of raw coal at both a zero and a 15 percent DCFROR. These ranges are graphically illustrated in Figures 3.2 and 3.3.

Operating Costs

Mine operating costs (labor plus materials and supplies) for the Indonesian mines are higher than for the U.S. mines because of higher stripping ratios, limited economies of scale, lower labor productivity, and higher costs for materials and supplies. As shown in Table 3.1, the average stripping ratios at the Indonesian coal mines are twice as high as the U.S. mines. In general, U.S. mines are larger than the Indonesian mines and tend to use larger mining equipment. Labor productivity is lower for the Indonesian mines because of higher stripping ratios, smaller mining equipment, more difficult mining conditions, and local management practices. This lower labor productivity is offset by lower wage rates in Indonesia. Some of the Indonesian mines are currently using contractors for coal mining and overburden removal.

Labor costs range from $0.58 to $3.60 per metric ton at the U.S. mines and $1.85 to $7.13 per metric ton for the Indonesian mines. Although basic mining wages are much lower in Indonesia than in the United States (approximately $50 to $100 per week in Indonesia versus $600 to $900 per week in the United States), these are negated by much lower labor productivity rates in Indonesia. This lower labor productivity is a function of the higher stripping ratios and the higher level of support personnel that are found at these Indonesian mines. The labor costs

TABLE 3.1
CASE I: MINE OPERATING DATA

	U.S. Coal Mine Range	Indonesian Coal Mine Range
Annual Raw Coal Production (Mmt/yr)	2 - 15	2 - 10
Number of Coal Seams	1 - 3	1 - 5
Coal Thickness (m)	5 - 35	4 - 16
Stripping Ratio (BCM/Raw mt)	1.5 - 4.2	4.0 - 8.0
Preparation Yield (Percent)	100	85 - 100
Total Employment	109 - 220	470 - 2300
Operating Days per Year	300 - 363	280 - 360
Shift Length (hours)	8 - 10	8 - 10
Shifts per Day	1 - 2	1 - 3
Work Schedule (Days On/Days Off)	6/1 - 7/0	6/1
Mining Productivity * (Raw mt/Worker-Hour)	12 - 25	1 - 13
Overall Productivity ** (Product mt/Worker-Hour)	9 - 21	1 - 10

* Includes only direct mine labor.

** Includes mine and plant labor and support staff.

TABLE 3.2

CASE I: BASIC MINING COST COMPARISON

(U.S.$/mt OF RAW COAL)

COST CATEGORY At Zero Percent DCFROR Price	U.S. Range			Indonesian Range		
Mine Operating Costs	1.42	–	9.01	5.28	–	15.84
Labor	0.58	–	3.60	1.85	–	7.13
Materials & Supplies	0.84	–	5.41	3.43	–	8.71
Royalties and Land Costs	0.35	–	1.80	1.11	–	2.40
Production Taxes:	0.72	–	2.85	0.01	–	0.05
Property & Ad Valorum	0.18	–	0.86	0.01	–	0.05
Severance	0.14	–	1.00	0.00	–	0.00
Federal Black Lung	0.12	–	0.61	0.00	–	0.00
Abandoned Mine Lands	0.28	–	0.39	0.00	–	0.00
Income Taxes:	0.00	–	0.06	0.00	–	0.00
State Income Tax	0.00	–	0.00	0.00	–	0.00
Federal Income Tax	0.00	–	0.06	0.00	–	0.00
Capital Costs:	0.57	–	1.20	0.07	–	2.15
After-tax Return of Capital	0.57	–	1.20	0.07	–	2.15
After-tax Return on Capital	0.00	–	0.00	0.00	–	0.00
Total Cost	2.78	–	14.36	8.25	–	17.77

COST CATEGORY At 15 Percent DCFROR Price	U.S. Range			Indonesian Range		
Mine Operating Costs	1.42	–	9.01	5.28	–	15.84
Labor	0.58	–	3.60	1.85	–	7.13
Materials & Supplies	0.84	–	5.41	3.43	–	8.71
Royalties and Land Costs	0.66	–	2.02	1.46	–	2.79
Production Taxes:	1.36	–	3.10	0.01	–	0.05
Property & Ad Valorum	0.36	–	0.97	0.01	–	0.05
Severance	0.37	–	1.13	0.00	–	0.00
Federal Black Lung	0.23	–	0.61	0.00	–	0.00
Abandoned Mine Lands	0.39	–	0.39	0.00	–	0.00
Income Taxes:	0.00	–	0.15	0.36	–	0.84
State Income Tax	0.00	–	0.00	0.00	–	0.00
Federal Income Tax	0.00	–	0.15	0.36	–	0.84
Capital Costs:	1.51	–	2.96	1.02	–	3.48
After-tax Return of Capital	0.57	–	1.20	0.07	–	2.15
After-tax Return on Capital	0.79	–	2.39	0.95	–	1.70
Total Cost	5.24	–	16.15	10.79	–	20.70

Notes: Totals may not add because they represent costs at different mines. Cost components within a column may be from several different mines to illustrate the range of typical costs in the respective countries.

Figure 3.2

Case I: Basic Mining Cost Components

(Zero Percent DCFROR)

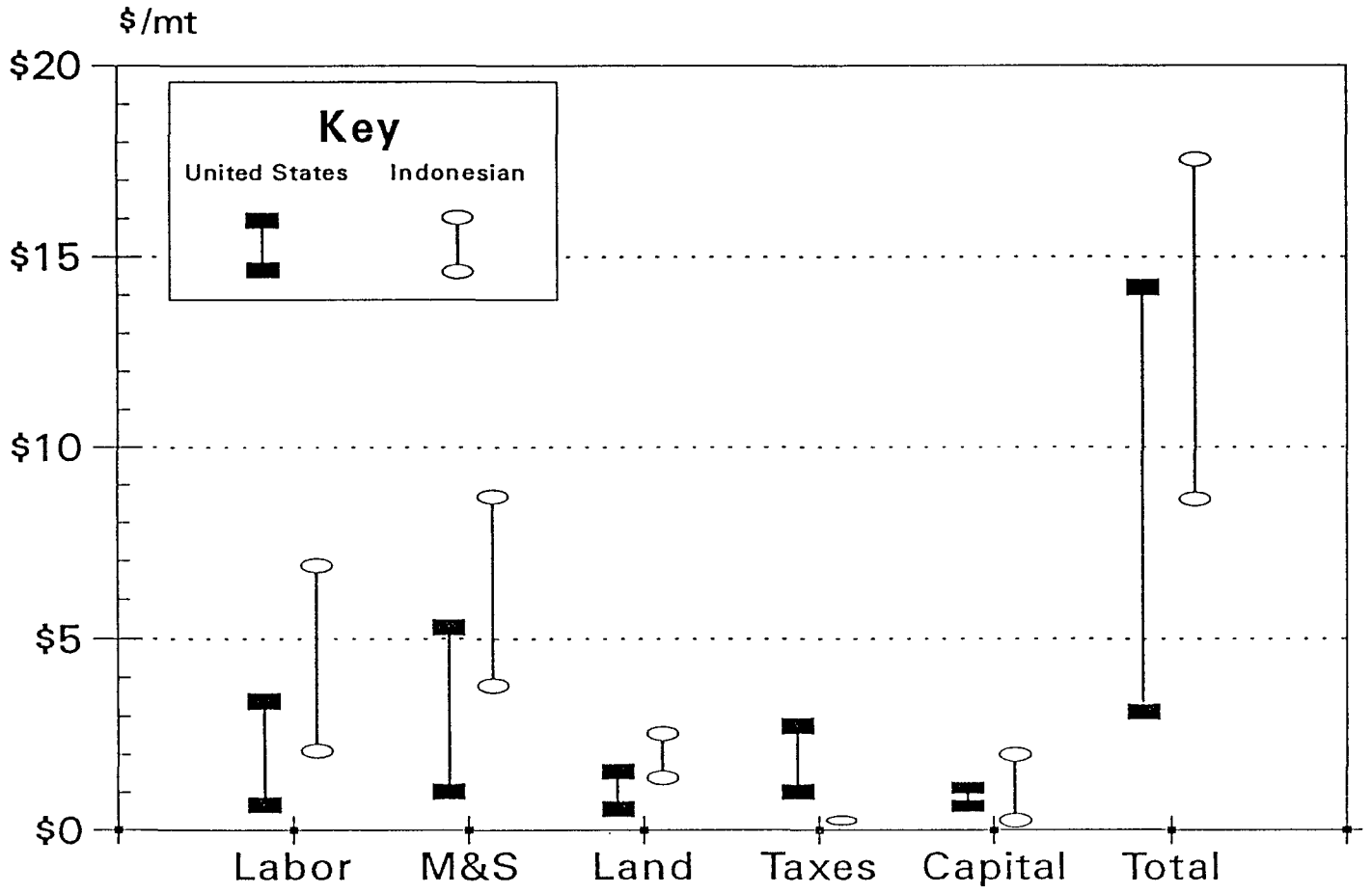
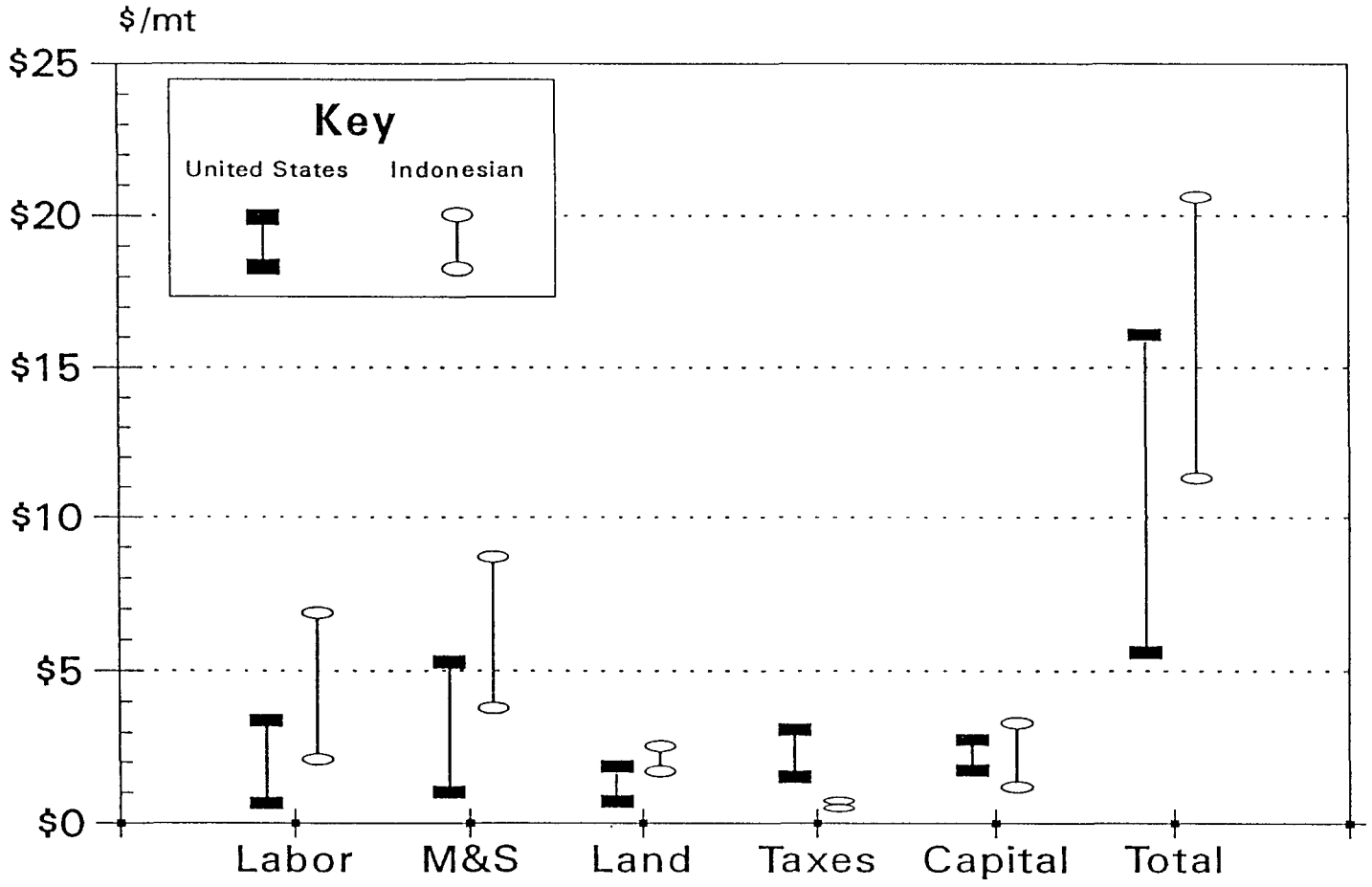


Figure 3.3

Case I: Basic Mining Cost Components

(15 Percent DCFROR)



associated with professional and managerial personnel in Indonesia are much higher than the wages of the miners. Added to these basic labor costs are the overhead costs associated with the remote mining operations on Kalimantan.

Material and supply costs range from $0.84 to $5.41 per metric ton at the U.S. mines and $3.43 to $8.71 per metric ton for the Indonesian mines. Higher costs for materials and supplies at the Indonesian mines reflect higher stripping ratios and the local costs of these items. Many repair parts have to be imported, and prices include additional shipping and handling charges. The Indonesian coal mining industry is relatively young, and many of the support functions (machine shops, equipment rebuilders, etc.) that are taken for granted in the United States are limited and costly in Indonesia. All explosives and blasting agents are controlled by DAHANA (a Government company) and are more expensive than comparable products in the United States. In addition, most of the Indonesian coal mines are in remote, undeveloped areas that involve higher procurement and transportation costs than are typical in the United States. These higher costs are somewhat moderated by lower fuel costs in Indonesia.

Total operating costs range from $5.28 to $15.84 per metric ton at the Indonesian mines and $1.42 to $9.01 at the U.S. mines. These differences are primarily due to higher stripping ratios, differences in mine size, lower labor productivity, and higher costs for materials and supplies at the Indonesian mines. Overall, mine operating costs represent from 51 to 63 percent of the total cost for U.S. mines and from 64 to 89 percent for the Indonesian mines.

Royalties and Land Costs

Royalties and land costs are significantly higher at Indonesian mines than at U.S. mines ($1.11 to $2.40 per metric ton in Indonesia versus $0.35 to $1.80 per metric ton in the United States). Both the surface and mineral rights at these Indonesian coal mines are owned by the Government. The coal contractors pay damages for disturbing settlements on these properties. The majority of the surface and mineral rights at the U.S. mines are owned by the U.S. Federal Government. These royalties and land costs represent approximately 13.5 percent of gross revenues at these Indonesian mines versus 12.5 percent of gross revenues at the U.S. mines.

Taxes

Production taxes are significantly higher in the U.S. than in Indonesia. At the zero percent DCFROR prices, production taxes at the U.S. operations ranged from $0.72 to $2.85 per metric ton versus $0.01 to $0.05 per metric ton in Indonesia. The primary U.S. production taxes include local property and ad valorem

taxes, State severance taxes, Federal Black Lung Tax, and Abandoned Mine Land Taxes. Income taxes are negligible at both the Indonesian and U.S. operations at these break-even prices.

At the 15 percent DCFROR prices, production taxes at the U.S. operations ranged from $1.36 to $3.10 per metric ton versus $0.01 to $0.05 per metric ton in Indonesia. Income taxes ranged from zero to a cost of $0.15 per metric ton at the U.S. mines and a cost of $0.36 to $0.84 per metric ton at the Indonesian mines.

Total tax costs at zero percent DCFROR range from 20 to 26 percent of total costs for U.S. mines versus less than 1 percent of total costs for the Indonesian mines. At a 15 percent DCFROR, total tax costs range from 19 to 27 percent of total costs for U.S. mines and from 3 to 4 percent of total costs for Indonesian mines. Indonesia's income tax terms for the coal contractors were designed to stimulate development in remote areas and to minimize some of the risks inherent in these greenfield mines.

Capital Costs

The ranges in capital costs for both the U.S. and Indonesian mines reflect the total capital investment for the mine and mining equipment and includes both initial and replacement capital. The return of capital for the U.S. mines ranges from $0.57 to $1.20 per metric ton and from $0.07 to $2.15 per metric ton for the Indonesian mines. The $0.07 per metric ton capital cost occurs at an Indonesian mine that uses contractors for both overburden removal and coal mining. The 15 percent return on capital costs range from $0.79 to $2.39 per metric ton at the U.S. mines and from $0.95 to $1.70 at the Indonesian mines.

At a zero percent DCFROR, the capital costs for the U.S. mines range from 8 to 20 percent of total mine cost, and, for the Indonesian mines, the range is from 1 to 12 percent. At a 15 percent DCFROR, capital ranges from 18 to 29 percent of total mine costs at the U.S. mines versus 9 to 17 percent at the Indonesian mines.

In general, the capital components of basic mining costs are slightly higher at Indonesian mines. This reflects higher stripping ratios and higher local costs of equipment and supplies. There are also greater economies of scale associated with the larger U.S. mines.

Selected Health, Safety, and Environmental Compliance Costs

The ranges in the costs of complying with certain health, safety, and environmental regulations are compiled in Table 3.3 Compliance costs that could be isolated and computed are mandatory training, equipment modifications, personal equipment

TABLE 3.3

CASE I: SELECTED REGULATORY COMPLIANCE COSTS

(U.S.$/mt OF RAW COAL)

Cost Category At Zero Percent DCFROR Price	U.S. Range			Indonesian Range		
Mine Safety and Health	0.15	–	0.67	0.00	–	0.00
Training	0.01	–	0.01	0.00	–	0.00
Dust Control	0.02	–	0.05	0.00	–	0.00
Black Lung Tax	0.12	–	0.61	0.00	–	0.00
Environmental	0.33	–	0.75	0.29	–	0.49
Reclamation	0.05	–	0.34	0.27	–	0.44
Water Treatment	0.00	–	0.02	0.02	–	0.05
Reclamation Fee	0.28	–	0.39	0.00	–	0.00
Total	0.48	–	1.42	0.29	–	0.49

Notes: Totals may not add because they represent costs at different mines. Cost components within a column may be from several different mines to illustrate the range of typical costs in the respective countries.

and safety facilities, pneumoconiosis tax, treatment of water discharge, reclamation costs, and reclamation-related taxes.

While the training of mine workers in Indonesian coal mines is a safety-related cost, these costs are not included in this analysis because they are not mandated by regulation. Where training costs could be identified for the Indonesian mines, these costs were treated as part of the mine operating costs.

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 Tax to $1.10 per short ton of coal mined by underground methods and to $0.55 per short ton of surface-mined coal. The total Black Lung Tax cannot exceed 4.4 percent of the mine-mouth value of the coal. Lignite mines are specifically exempted from this tax.

The costs of complying with these identifiable safety and health regulations for U.S. mines range from $0.15 to $0.67 per metric ton. There are no comparable costs for Indonesian mines. The highest regulatory cost item for the U.S. mines was the Black Lung Tax.

In this analysis, environmental compliance costs are limited to reclamation expenses, water treatment costs, and reclamation fees (taxes). The Abandoned Mine Land Reclamation Fee was established in 1977 by the U.S. Congress as part of a comprehensive surface mining and reclamation law setting 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, was set at $0.15 per short ton of coal extracted by underground methods. For coal mined by surface methods, the fee was set at $0.35 per short ton of 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 per short ton, whichever is less. The Indonesian government imposes no comparable fee on coal mines. The costs of complying with U.S. environmental regulations ranged from $0.33 to $0.75 per metric ton. The costs of complying with Indonesian environmental regulations ranged from $0.29 to $0.49 per metric ton. The Abandoned Mine Land Reclamation Fee was the largest part of the U.S. environmental costs, and the cost of reclamation (topsoil removal and replacement, regrading, reseeding, etc.) was the largest Indonesian reclamation cost.

The total regulatory costs isolated in this analysis for the selected compliance activities range from $0.48 to $1.42 for the U.S. mines and from $0.29 to $0.49 for the Indonesian mines. The primary differences in regulatory costs were the U.S. Black Lung Tax and the U.S. Abandoned Mine Land Reclamation Fee.

Total Basic Mining Costs

The Case I flat-lying surface mines in the U.S. have lower basic mining costs than similar mines in Indonesia. As illustrated in Figure 3.2, the U.S. mines have about a $5 per metric ton cost advantage over the Indonesian mines. At a zero percent DCFROR, costs range from $2.78 to $14.36 per metric ton for the U.S. mines versus $8.25 to $17.77 per metric ton for the Indonesian mines. At a 15 percent DCFROR, the U.S. costs are $5.24 to $16.15, while the Indonesian costs are $10.79 to $20.70 (see Figure 3.3). U.S. mines have lower operating, land, and capital costs. The Indonesian mines have lower total tax costs. Many of the U.S. costs are lower because of lower stripping ratios, higher labor productivity, and greater economies of scale.

Case II: Large, Steeply Dipping Surface Coal Mines

Case II compares three surface mining operations in Indonesia with three similar mines in the Western United States. Operating data on these mines are summarized in Table 3.4.

The steeply dipping coal seams at these mines have led to non-typical mining practices that have been developed for the specific conditions at each mine. At these mines, different mining techniques are frequently used within the same coal deposit to address distinct geologic and mining conditions. Some Indonesian mines use dozers and rippers to fragment and push much of the overburden into previously mined pits. The U.S. mines have to drill and blast the overburden. All of these mines use trucks and shovels for overburden removal. Either shovels or backhoes are used with trucks for coal mining. Some of these mines are currently examining continuous surface mining equipment, continuous haulage systems and other technologies to increase production and/or lower costs.

The dips of the coal seams at these mines range from 20 percent to almost vertical. Stripping ratios vary from 3 to 8 BCM/mt of raw coal. The total coal seam thickness recovered ranges from 5 to more than 70 m at these mines. Details on the mines used in this case are given in Appendix C.

The basic mining cost ranges for Case II are shown in Table 3.5. The ranges represent the costs to extract one metric ton of raw coal at both a zero and a 15 percent DCFROR. These ranges are graphically illustrated in Figures 3.4 and 3.5.

Operating Costs

Mine operating costs (labor plus materials and supplies) for the Indonesian mines are lower than the U.S. mines because of lower wage rates, less-complex mining conditions, unconsolidated overburden that does not require blasting, and greater economies

TABLE 3.4
CASE II: MINE OPERATING DATA

	U.S. Coal Mine Range	Indonesian Coal Mine Range
Annual Raw Coal Production (Mmt/yr)	1 - 4	3 - 20
Number of Coal Seams	4 - 12	1 - 3
Coal Thickness (m)	3 - 8	3 - 70
Stripping Ratio (BCM/Raw mt)	4 - 7	3 - 8
Preparation Yield (Percent)	100	100
Total Employment	110 - 360	400 - 800
Operating Days per Year	247 - 250	280 - 360
Shift Length (hours)	8	8 - 10
Shifts per Day	2 - 3	2 - 3
Work Schedule (Days On/Days Off)	5/2	6/1 - 7/0
Mining Productivity * (Raw mt/Worker-Hour)	3 - 6	1 - 3
Overall Productivity ** (Product mt/Worker-Hour)	3 - 6	1 - 3

* Includes only direct mine labor.

** Includes mine and plant labor and support staff.

TABLE 3.5
CASE II: BASIC MINING COST COMPARISON
(U.S.$/mt OF RAW COAL)

COST CATEGORY	United States			Indonesian		
At Zero Percent DCFROR Price	Range			Range		
Mine Operating Costs	9.65	–	10.58	6.25	–	6.59
Labor	3.86	–	6.45	2.19	–	2.96
Materials & Supplies	4.13	–	5.79	3.62	–	4.06
Royalties and Land Costs	1.34	–	2.12	1.09	–	1.51
Production Taxes:	3.14	–	3.55	0.01	–	0.01
Property & Ad Valorum	0.68	–	1.31	0.01	–	0.01
Severance	1.24	–	1.47	0.00	–	0.00
Federal Black Lung	0.61	–	0.61	0.00	–	0.00
Abandoned Mine Lands	0.39	–	0.39	0.00	–	0.00
Income Taxes:	0.00	–	0.00	0.00	–	0.17
State Income Tax	0.00	–	0.00	0.00	–	0.00
Federal Income Tax	0.00	–	0.00	0.17	–	0.17
Capital Costs:	2.16	–	4.63	0.86	–	3.55
After-tax Return of Capital	2.16	–	4.63	0.86	–	3.55
After-tax Return on Capital	0.00	–	0.00	0.00	–	0.00
Total Cost	16.82	–	19.18	8.08	–	11.21

COST CATEGORY	United States			Indonesian		
At 15 Percent DCFROR Price	Range			Range		
Mine Operating Costs	9.65	–	10.58	6.25	–	6.59
Labor	3.86	–	6.45	2.19	–	2.96
Materials & Supplies	4.13	–	5.79	3.62	–	4.06
Royalties and Land Costs	1.59	–	3.51	1.29	–	1.99
Production Taxes:	3.57	–	4.01	0.01	–	0.01
Property & Ad Valorum	1.00	–	1.52	0.01	–	0.01
Severance	1.50	–	1.58	0.00	–	0.00
Federal Black Lung	0.61	–	0.61	0.00	–	0.00
Abandoned Mine Lands	0.39	–	0.39	0.00	–	0.00
Income Taxes:	0.00	–	0.17	0.32	–	0.72
State Income Tax	0.00	–	0.09	0.00	–	0.00
Federal Income Tax	0.00	–	0.08	0.32	–	0.72
Capital Costs:	5.65	–	7.82	1.63	–	6.94
After-tax Return of Capital	2.16	–	4.63	0.86	–	3.55
After-tax Return on Capital	1.66	–	4.65	0.77	–	3.39
Total Cost	20.04	–	31.73	9.58	–	14.75

Notes: Totals may not add because they represent costs at different mines. Cost components within a column may be from several different mines to illustrate the range of typical costs in the respective countries.

Figure 3.4

Case II: Basic Mining Cost Components

(Zero Percent DCFROR)

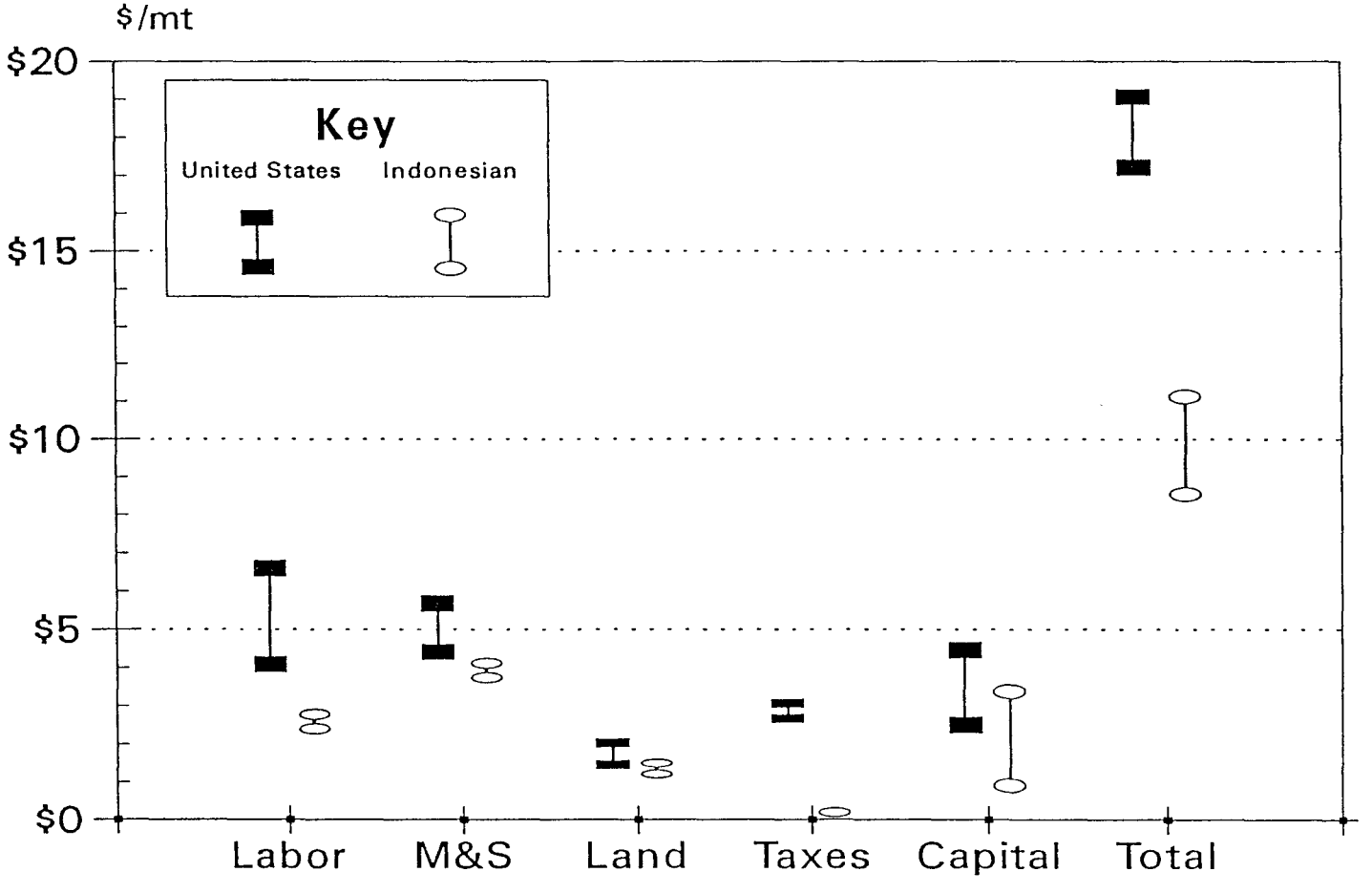
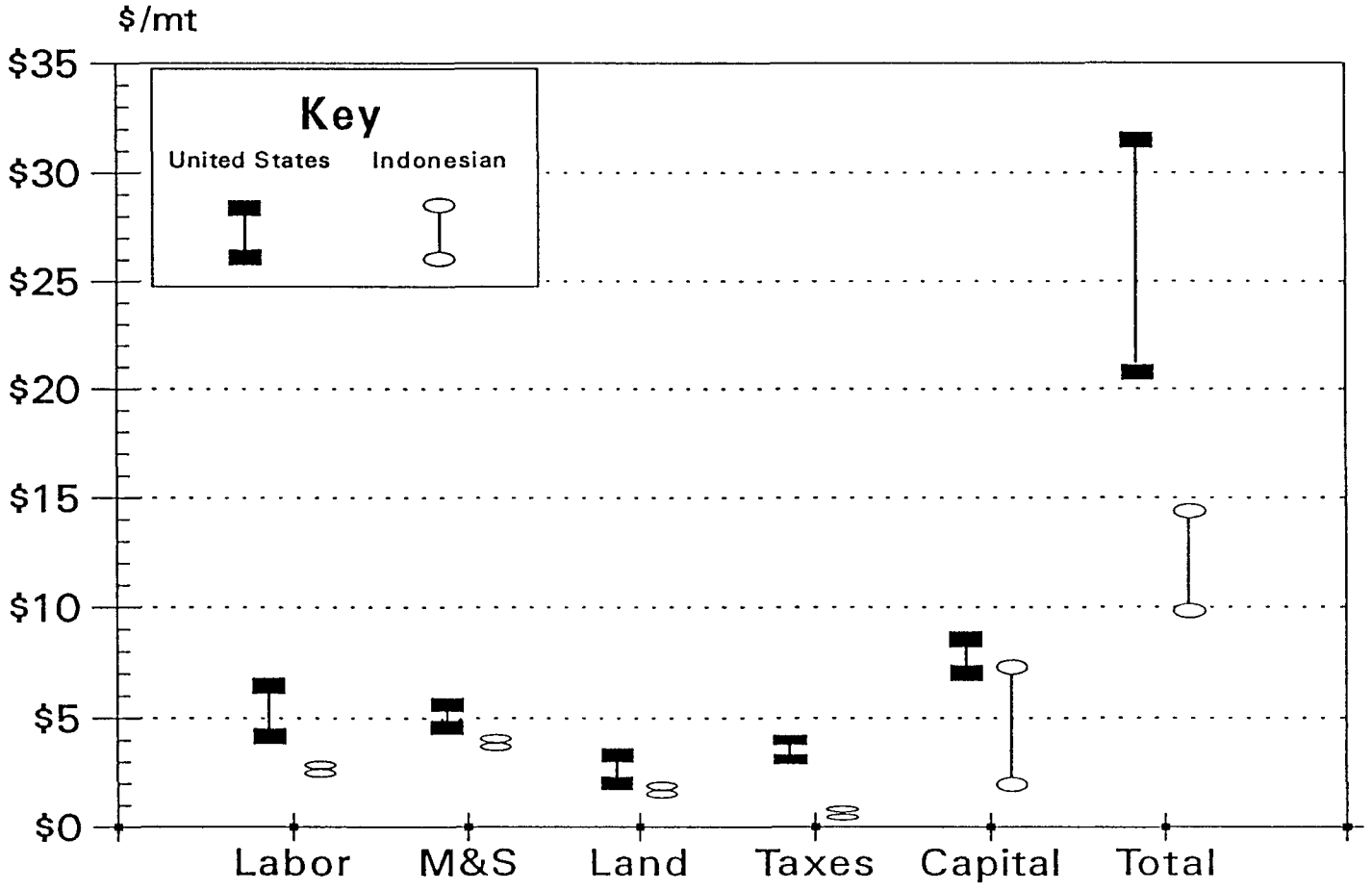


Figure 3.5

Case II: Basic Mining Cost Components

(15 Percent DCFROR)



of scale. This is offset by lower labor productivity and higher unit costs of materials and supplies in Indonesia. As shown in Table 3.4, the average stripping ratios at the Indonesian coal mines are approximately equivalent to the U.S. mines. In general, Indonesian mines are larger than the U.S. mines and use larger mining equipment. Some of the Indonesian mines are using contractors for basic coal mining and overburden removal.

Labor costs range from $3.86 to $6.45 per metric ton at the U.S. mines and $2.19 to $2.96 per metric ton for the Indonesian mines. Although basic mining wages are much lower in Indonesia than in the United States, these lower wages are offset by lower labor productivity rates at the Indonesian mines.

Material and supply costs range from $4.13 to $5.79 per metric ton at the U.S. mines and $3.62 to $4.06 per metric ton for the Indonesian mines. Although the unit costs of materials and supplies are typically higher in Indonesia than in the United States, this is offset by the elimination of blasting costs and the less complex mining conditions found at these Indonesian mines.

Total operating costs range from $9.65 to $10.58 at the U.S. mines and from $6.25 to $6.59 per metric ton at the Indonesian mines. These differences are primarily due to lower wage rates, less complex mining conditions, unconsolidated overburden that does not require blasting, and greater economies of scale. Overall, mine operating costs represent from 55 to 57 percent of the total cost for U.S. mines and from 59 to 77 percent for the Indonesian mines.

Royalties and Land Costs

Royalties and land costs are slightly lower at Indonesian mines than at U.S. mines ($1.09 to $1.51 per metric ton in Indonesia versus $1.34 to $2.12 per metric ton in the United States). Both the surface and mineral rights at these Indonesian coal mines are owned by the Government. The coal contractors must pay damages for disturbing settlements on these properties. The majority of the surface and mineral rights at the U.S. mines are owned by the U.S. Federal Government. These royalties and land costs represent approximately 13.5 percent of total costs at the Indonesian mines versus 8 percent to 11 percent of total costs at the U.S. mines.

Taxes

Production taxes are significantly higher in the U.S. than in Indonesia. At the zero percent DCFROR prices, production taxes at U.S. operations ranged from $3.14 to $3.55 per metric ton versus $0.01 per metric ton in Indonesia. The primary U.S. production taxes include local property and ad valorem taxes, State severance taxes, Federal Black Lung Tax and Abandoned Mine

Land Fee. Production taxes are particularly high for these steeply dipping U.S. mines because the break-even coal prices are relatively high. At these break-even prices, there were no income taxes at the U.S. mines. Income taxes at the Indonesian mines ranged from zero to $0.17 per metric ton.

At the 15 percent DCFROR prices, production taxes at the U.S. operations ranged from $3.57 to $4.01 per metric ton versus $0.01 per metric ton in Indonesia. Income taxes ranged from zero to $0.17 per metric ton at the U.S. mines and from $0.32 to $0.72 per metric ton at the Indonesian mines.

The total tax burdens at U.S. coal mines are significantly higher than at Indonesian coal mines. Total taxes at the zero percent DCFROR price range from zero to 2 percent of basic mining costs at the Indonesian mines compared to 16 to 17 percent at the U.S. mines. At the 15 percent DCFROR price range, total taxes are 3 to 5 percent of basic mining costs at the Indonesian mines versus 12 to 14 percent at the U.S. mines.

Capital Costs

The ranges in the capital costs for both the U.S. and Indonesian mines reflect the total capital investment for the mine and mining equipment and include both initial and replacement capital. The cost needed to return the capital investment (zero percent DCFROR) at the U.S. mines ranged from $2.16 to $4.63 per metric ton at the U.S. mines versus $0.86 to $3.55 per metric ton at the Indonesian mines. The cost of construction in Indonesia is higher than in the U.S. because of many of the same reasons as listed under operating costs. This is offset by the larger mines in Indonesia and the related economies of scale. The 15 percent DCFROR return on the capital invested at the U.S. mines ranged from $1.66 to $4.65 per metric ton versus $0.77 to $3.39 per metric ton for the Indonesian mines. The return-on-capital component is lower for the Indonesian mines because of lower capital levels and the larger production capacities. At the zero percent DCFROR price, the capital cost for the U.S. mines is from 13 to 24 percent of total mine cost, and, for the Indonesian mines, the range is from 11 to 32 percent. The 15 percent DCFROR return on capital cost is 8 to 15 percent of total costs at the U.S. mines versus 8 to 23 percent at the Indonesian mines.

Selected Health, Safety, and Environmental Compliance Costs

The ranges in the costs of complying with certain health, safety, and environmental regulations are compiled in Table 3.6 Compliance costs include mandatory training, equipment modifications, personal equipment and safety facilities, Black Lung Tax, treatment of water discharge, reclamation costs, and reclamation-related taxes.

TABLE 3.6
CASE II: SELECTED REGULATORY COMPLIANCE COSTS
(U.S.$/mt OF RAW COAL)

Cost Category At Zero Percent DCFROR Price	U.S. Range			Indonesian Range		
Mine Safety and Health	0.64	–	0.67	0.00	–	0.00
Training	0.01	–	0.01	0.00	–	0.00
Dust Control	0.02	–	0.05	0.00	–	0.00
Black Lung Tax	0.61	–	0.61	0.00	–	0.00
Environmental	0.67	–	0.89	0.10	–	0.46
Reclamation	0.28	–	0.48	0.08	–	0.41
Water Treatment	0.00	–	0.02	0.02	–	0.05
Reclamation Fee	0.39	–	0.39	0.00	–	0.00
Total	1.31	–	1.56	0.10	–	0.46

Notes: Totals may not add because they represent costs at different mines. Cost components within a column may be from several different mines to illustrate the range of typical costs in the respective countries.

The cost of complying with these identifiable safety and health regulations for the U.S. mines range from $0.64 to $0.67 per metric ton. There are no comparable costs for the Indonesian mines. The highest regulatory cost item for the U.S. mines was the Black Lung Tax.

The costs of complying with U.S. environmental regulations ranged from $0.67 to $0.89 per metric ton. The costs of complying with Indonesian environmental regulations ranged from $0.10 to $0.46 per metric ton. Although the reclamation costs per disturbed hectare in Indonesia are higher than in the United States, thicker coal seams at these Indonesian mines result in a lower reclamation cost on a tonnage basis.

The Abandoned Mine Land Reclamation Fee was the largest part of the U.S. environmental costs, and the cost of reclamation (topsoil removal and replacement, regrading, reseeding, etc.) was the largest item under the Indonesian reclamation costs. The total regulatory costs isolated in this analysis for the selected compliance activities range from $1.31 to $1.56 per metric ton for the U.S. mines and from $0.10 to $0.46 per metric ton for the Indonesian mines. The primary differences in regulatory costs were the U.S. Black Lung Tax and the U.S. Abandoned Mine Land Reclamation Fee.

Total Basic Mining Costs

The Case II steeply dipping surface mines in the U.S. have significantly higher basic mining costs than similar mines in Indonesia. The primary contributors to this cost difference include complex mining conditions (multiple seams), thinner coal seams, lower production levels, higher regulatory costs, and production taxes. As illustrated in Figure 3.4, Indonesian mines have an approximate $8.00 per metric ton cost advantage over U.S. mines. At a zero percent DCFROR, costs range from $16.82 to $19.18 per metric ton for U.S. mines versus $8.08 to $11.21 per metric ton for Indonesian mines. At a 15 percent DCFROR, the U.S. costs are $20.04 to $31.73 per metric ton, while the Indonesian costs are $9.58 to $14.75 per metric ton (see Figure 3.5). As noted in the cost component discussions, Indonesian mines have lower operating, land, tax, and capital costs.

Summary of Case Study Findings

Case Study I shows that basic mining costs for flat-lying coal mines are lower in the United States than in Indonesia. In Case I, the U.S. flat-lying surface mines have a mine-mouth cost advantage that ranges from $3.41 to $5.47 per metric ton at a zero percent DCFROR to $4.55 to $5.55 per metric ton at a 15 percent DCFROR. The primary cost advantages of the U.S. flat-lying surface mines are lower stripping ratios and greater economies of scale. Lower labor costs in Indonesia are countered

by higher labor productivity at the U.S. mines. Lower operating and land costs at the flat-lying U.S. surface mines are offset by higher tax costs. Capital costs do not appear significantly different at these mines.

Case Study II shows that the basic mining costs for steeply dipping surface mines in Indonesia are lower in Indonesia than in the United States. In Case II, the Indonesian steeply dipping surface mines have a mine-mouth cost advantage that ranges from $7.97 to $8.74 per metric ton at a zero percent DCFROR to $10.46 to $16.98 per metric ton at a 15 percent DCFROR. The primary cost advantages of the Indonesian steeply dipping surface mines are less complex mining conditions and greater economies of scale. The Indonesian steeply dipping mines have lower operating, lower land, and lower tax costs than the U.S. mine. Capital costs are lower at the Indonesian mines, particularly at the 15 percent DCFROR.

Land costs at Indonesian coal mines are slightly higher than those paid by the U.S. mines on a percentage basis. The Indonesian mines pay 13.5 percent of their product to the Indonesian Government. Most of the coal extracted at the U.S. mines included in this study is owned by the Federal Government and is subject to a 12.5 percent royalty based on gross proceeds plus a bonus bid (in some cases).

Tax costs for the U.S. mines are considerably higher than those for the Indonesian mines. The tax charges that account for most of the differences are production taxes: Black Lung Tax, Abandoned Mine Land Reclamation Fee, and State severance taxes.

Indonesian mines have lower regulatory compliance costs because of the lack of a Black Lung (pneumoconiosis) Tax and Abandoned Mine Land Reclamation Fee. Compliance costs for the U.S. mines are $0.35 to $1.10 per metric ton higher than for the Indonesian mines.

CHAPTER 4

MARKET ANALYSIS

This chapter examines the relative competitiveness of Indonesian and U.S. mines producing thermal coals of similar quality delivered to three major thermal coal markets: the U.S. Mississippi River, Europe, and Japan. While the coals in each case study have similar coal quality characteristics and utilization characteristics; the geology of the deposit, type of mine, annual production, mining method, beneficiation, and transportation modes vary significantly among these mines.

Indonesia's growing export coal industry's primary market is the Pacific Rim (Japan, Korea, Hong Kong, Taiwan, Singapore, and Malaysia). Europe is a secondary market because of higher shipping costs. Although niche markets may develop in North and South America, only test tonnages have been shipped to date.

Competitiveness in International Coal Markets

Competitiveness in international coal markets is related to several tangible and intangible factors: delivered price, consistency of coal quality, reliability of supply, diversification of supply, exchange rate movements, etc. In these case studies on relative market competitiveness, only the delivered costs for comparable coal products are analyzed.

Delivered cost is composed of two major cost components. The first is the total cost to produce a metric ton of salable coal at the mine's shipping point. This mine-mouth cost includes the basic mining cost, transportation from the mine to the plant, processing costs (sizing, beneficiation, etc.), costs associated with loading the coal for overland transportation, taxes, and royalties. This mine-mouth cost is sometimes called a free-of-rail cost or the f.o.b. mine cost. The other major cost is the cost of transportation from the mine to the consumer. Transportation cost includes the cost of transporting the coal to an export port, ship loading costs, custody transfer services, export duties, and the cost of ocean transport to the receiving port (all coals are transported to the point of utilization for domestic U.S. markets). Because the coal products that are compared in this study have similar qualities, differences in utilization costs (heat content, plant efficiency, pollution control, ash disposal, etc.) are not explicitly considered.

The basic mining cost is dependent upon numerous factors as described in Chapter 3. Some of these cost factors are controllable by the mine operator; others are influenced by geology, location, the costs of inputs (wages, supplies, etc.); and governmental policies and regulations. Processing costs are a function of plant throughput, preparation yield, preparation

method(s), cost of inputs, reject disposal costs, environmental costs, etc. Loading costs are a function of the transportation mode, input costs, loading rate, loading technology, etc.

The cost of transporting coal to an export terminal is a function of the distance from the mine to the port, transport mode, and the degree of intra- and inter-modal transport competition. Inland transportation usually involves movement by truck, rail, barge, or some combination. Ocean shipping cost is a function of the size of the vessel, the distance from the export port to the receiving port, the term of the shipping agreement, loading and unloading rates, market conditions, etc.

Since international coal purchases are typically denominated in U.S. dollars, a major factor affecting the competitiveness of U.S. coal is the value of the dollar relative to the currency of competing suppliers (exchange rates). At the time of this competitive analysis (December 1992), one U.S. dollar was worth approximately Rp 2,055.

Methodology and Analysis

The mine-mouth costs used in these market comparisons consist of the basic mining costs that were developed in Chapter 3 plus the additional costs of processing the coal (sizing, beneficiation, yield-loss, etc.) and any costs associated with loading the coal for overland transportation (train loading, etc.). This mine-mouth cost is the average cost to produce one metric ton of a salable coal product (f.o.b. railcar, etc.) during the total life of the mine.

These market cases compare production costs only at a zero percent rate of return on the capital investment. The zero percent return represents a price at the mine that covers all costs (expenses, capital, royalties and taxes) but does not include any profit or return on investment.

Transportation costs in this study are typical prices paid by the shipper. Transport costs are based on typical shipment modes and routes. The transportation costs in this study represent costs that would have been incurred by a shipper in December 1992 to move coal from a specific mine or mines to the consumer. Shipping costs were obtained from a variety of sources--publications; truck, rail, barge, steamship, and stevedore companies; terminal and mine operators; and port authorities.

The market costs developed in this study should not be used to evaluate specific market transactions. These market costs represent average costs and do not address the impact of long-term contracts, expectations of future coal markets by both buyers and sellers, expectations of future exchange rates, variable costing of incremental production, future productivity increases, etc. Currently, many coal producers seem to be

pursuing market share at the expense of profits. This is particularly true for several of the Indonesian mines that are just beginning commercial production. Some of these Indonesian mines are utilizing contractors for mining and transportation and are mining extremely low stripping ratio coals. Some of these mines will require higher coal prices over the longer term. All of these costs are time specific and ocean freight rates are particularly variable. Costs that are denominated in Indonesian rupiahs are directly affected by exchange rates.

Case III: U.S. Mississippi River Thermal Coal Market

Case III examines the relative competitiveness of selected U.S. and Indonesian mines supplying a U.S. electric utility generating station situated on the Mississippi River near St. Louis, Missouri. This market has traditionally relied on high-sulfur coals from the Illinois basin. The U.S. Clean Air Act Amendments of 1990 (CAAA) requires the 110 U.S. generating units that emit the most sulfur dioxide (SO_2) to reduce their average SO_2 emissions to less than 2.5 pounds of SO_2 per million British thermal units (Btu) of heat input by 1995 (Phase I).[15] By the year 2000, almost all generating units must emit less than 1.2 pounds of SO_2 per million Btu of heat input (Phase II). Many of the 110 units targeted in Phase I are on the Mississippi and Ohio River systems. These plants have several options of complying with these emission reduction regulations:

1. Install flue gas desulfurization (FGD) equipment.
2. Switch to lower sulfur coals (or blends).
3. Switch to alternate fuels (natural gas).

Switching to lower sulfur coal appears to be the most popular choice of compliance strategies for the generating units affected by Phase I of the CAAA with switching to alternative fuels being the second most popular option.[16] The primary source of low-sulfur coal for these units is predicted to be the Powder River basin of the Western United States.[17] A possible alternative for this low-sulfur Powder River basin coal would be low-sulfur imported coals. In fact, some of these units impacted by Phase I

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[15]The average SO_2 level is less than 2.5 pounds SO_2 per million Btu because the total emissions are capped at the 1985 through 1987 average fuel usage rate.

[16]"IIS study: Coal-switching is most popular option." Coal. v. 98, No. 11, Nov. 1991, pp. 7-8.

[17]"U.S. acid rain law will hit Central Appalachia exports." International Coal Report. v. 308, No. 4, Oct. 2, 1992, pp. 16-18.

of the CAAA have evaluated test burns of Indonesian coal.[18] This Indonesian coal is shipped through the Panama canal to the Lower Mississippi River where it is transloaded onto barges for upstream destinations.

Some of the Indonesian coals have unique quality characteristics such as extremely low sulfur and/or ash levels. While these coals may have additional value by generating SO_2 emission credits, this potential value is not considered in this analysis. Both the Indonesian and U.S. coals in this case meet the Phase II SO_2 emission limits.

There are three Indonesian mines and three U.S. mines in Case III. All of these mines have either supplied coal or could supply coal to the representative Mississippi River powerplant. The planned annual production of the Indonesian mines ranges from 3 Mmt of coal per year to more than 20 Mmt/yr. The U.S. mines produce from 2 Mmt of coal per year to more than 15 Mmt/yr.

The three Indonesian mines are surface operations that were included in cases I and II. The three U.S. mines are large surface mines that were included in Case I. All three U.S. mines are located in the State of Wyoming.

The powerplant that is used for this comparison is on the Mississippi River near St. Louis, Missouri. This plant has traditionally burned high-sulfur coals from the Illinois basin. This plant has indicated that it will probably switch to a low-sulfur, subbituminous coal to meet its Phase I emission limits. Although this plant will have a lower thermal efficiency and a lower maximum generating capacity as a result of switching to a lower rank coal, the potential cost savings of this conversion appear to be sufficient to offset this derating. This plant can receive coal from river barges and/or by rail. The quality of the thermal coals compared in this case range from 4,450 to 5,800 kcal/kg heating values, 1 percent to 9 percent ash, and 0.1 percent to 0.6 percent sulfur. All of these products are shipped without beneficiation other than crushing.

The Indonesian mines use trucks, barges, and/or rail to move coal to tidewater ports. These ports include large shore-based shiploaders and barge-mounted cranes in sheltered waters. The average ocean distance from Kalimantan to transloading facilities on the Lower Mississippi River via the Panama Canal is approximately 18,500 km. These ships will unload their cargoes in the Lower Mississippi River at ship-to-barge transloading facilities. From this point, river barges will be used to transport the coal to the powerplant, a distance of approximately 1,100 km.

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[18]"ENVIROCOAL arrives at Burnside." Int'l Coal Report. No. 310, Nov. 1992, p. 14.

The coal from the Wyoming mines is moved by unit trains from the mines to the powerplant. The typical unit train consists of 110 cars of 91-mt capacity for a total load of 9,982 mt. This rail distance is approximately 1,700 to 1,800 km.

Delivered Cost Comparisons and Findings

The delivered costs to a generating plant on the Mississippi River for select U.S. and Indonesian mines are shown in Table 4.1 and Figure 4.1. Delivered costs range from $34.69 to $49.11 per metric ton for the Indonesian coal mines and from $20.09 to $40.31 per metric ton for the U.S. mines. The delivered costs of the U.S. coals to this market are lower than the Indonesian coals. This competitive advantage is primarily because of the lower mine-mouth costs of the large U.S. mines in the Powder River Basin and the high ocean freight rates incurred by the Indonesian coals. However, there may be niche opportunities for the extremely low sulfur coals of Indonesia. These extremely low sulfur levels may allow a generating unit to meet the 1990 CAAA emission requirements by blending high-sulfur, midwestern coals and Indonesian coals.

U.S. mines located in the Powder River basin have mine-mouth costs that are less than one-half the mine-mouth costs of the Indonesian mines. These lower costs are primarily the results of lower stripping ratios and economies of scale. As illustrated in Case I, the land costs are approximately the same for Indonesian and U.S. mines, and the U.S. mines incur higher production-related taxes. The mines on the high end of both the Indonesian and U.S. cost ranges represent smaller, less efficient operations.

Total transportation costs for the Indonesian mines are higher than for the U.S. mines primarily because of ocean freight, port charges, transloading to barges, and barging up the Mississippi River incurred by the Indonesian mines. The average total shipping distance for the Indonesian mines is approximately 20,000 km, while the U.S. coal is transported 1,700 to 1,800 km by rail.

Case IV: European Thermal Coal Market

The electric utility industry in Europe is a growing market for imported steam coal. Historically, the United States has been a significant source of coal for European thermal coal plants. Thermal coal imports by European countries are projected to increase from 104 Mmt in 1990 to more than 200 Mmt in the year 2,000.[19] For comparison purposes, the Port of Amsterdam,

[19]Supplement to Annual Energy Outlook 1993, EIA, U.S. Department of Energy, Washington, D.C., 1993.

TABLE 4.1
CASE III: DELIVERED COST SUMMARY
($/mt)

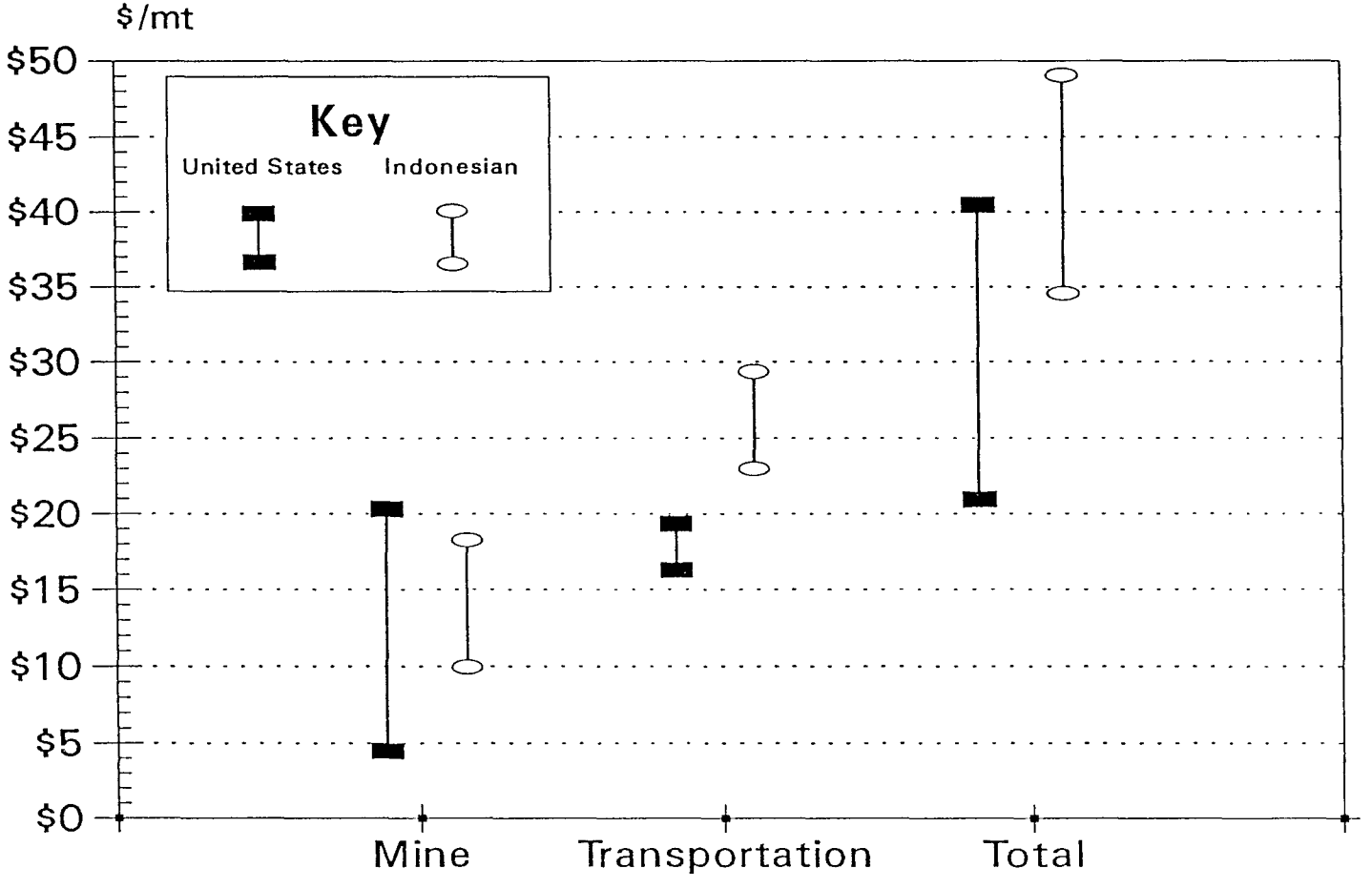
Cost Category at Zero Percent DCFROR	U.S. Range			Indonesian Range		
Total Mine-Mouth Cost	4.20	-	20.51	9.53	-	18.48
Production	2.67	-	13.65	8.24	-	15.99
Land and Taxes	1.53	-	6.86	1.29	-	2.49
Transportation	15.89	-	19.80	22.55	-	30.63
Trucking	0.00	-	0.00	0.00	-	0.00
Rail Rate	15.89	-	19.80	0.00	-	1.55
Barge	0.00	-	0.00	4.50	-	9.38
Port Charges	0.00	-	0.00	2.75	-	4.23
Ocean Freight	0.00	-	0.00	14.80	-	18.50
Total Delivered Costs	20.09	-	40.31	34.69	-	49.11

Notes: Totals may not add because they represent costs at different mines. Cost components within a column may be from several different mines to illustrate the range of typical costs in the respective countries.

Figure 4.1

Case III: Delivered Cost Components

(Zero Percent DCFROR)



Rotterdam, and Antwerp (ARA) is assumed to be the receiving port in Europe. U.S. exports move in capesize and Panamax vessels, and the Indonesian exports are assumed to move in capesize vessels.

Case IV uses three Indonesian mines from Cases I and II and three U.S. mines that are selling or have sold coal to European powerplants. The Indonesian mines include three large surface mines that produce from 2 to more than 8 Mmt/yr. These Indonesian coals require only crushing and partial washing to produce this thermal product. Combinations of truck, barge, conveyor, and/or rail transportation is used to move these coals to ports. These distances range from 12 to 450 km. The ocean shipping distance from east Kalimantan to ARA is approximately 15,000 km.

The three U.S. mines in this case are located in Alabama and Kentucky. Two of these mines are underground operations that use longwalls, and one is a surface operation that uses draglines and trucks and shovels. The annual production of these mines range from 2 to 3 Mmt/yr. All of these mines wash their coal with plant yields of 60 percent to 85 percent. Combinations of truck, rail, and barge transport are used to move these coals to export ports on the Lower Mississippi River, McDuffie Island, and Hampton Roads. Inland transportation distances range from 650 to 3,600 km. Ocean distances range from 8,100 to 10,400 km.

Delivered Cost Comparisons and Findings

The delivered costs for the U.S. and Indonesian mines are shown in Table 4.2 and Figure 4.2. Delivered costs range from $34.44 to $50.62 per metric ton for the Indonesian coal mines and from $44.02 to $65.71 per metric ton for the U.S. mines. In general, the delivered cost of Indonesian coals to this market is lower than U.S. coals. The Indonesian mines included in this case study show a $10 to $15 per metric ton delivered cost advantage over the U.S. mines. This competitive advantage is because of the lower mine-mouth costs and lower inland freight rates for the Indonesian mines.

The U.S. mines show an $8 to $12 per metric ton mine-mouth cost disadvantage when compared to the Indonesian mines. This cost disadvantage is influenced by the mining method (two of the U.S. mines are underground versus Indonesian surface mines), higher wage rates at U.S. mines, higher preparation costs for the U.S. mines, and the low stripping ratios and thick coal seams at the Indonesian mines. Land costs are lower at the U.S. mines that own the coal in fee. Production taxes are higher at the U.S. mines.

Total transportation costs for the Indonesian mines are approximately $3 to $5 per metric ton lower than the U.S. mines. Although the U.S. mines have shorter ocean shipping distances

TABLE 4.2
CASE IV: DELIVERED COST SUMMARY
($/mt)

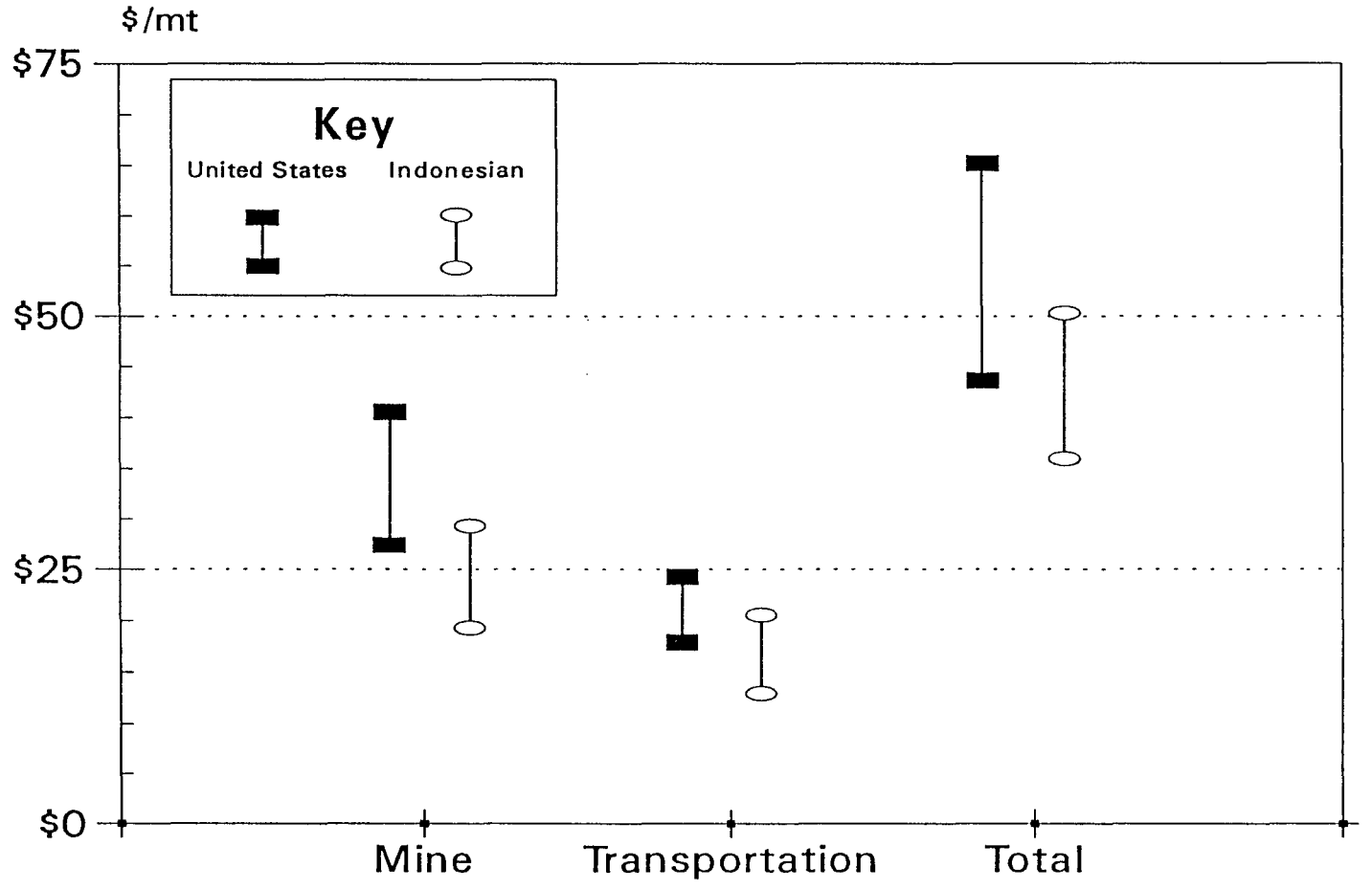
Cost Category at Zero Percent DCFROR	U.S. Range			Indonesian Range		
Total Mine-Mouth Cost	26.57	-	41.11	18.47	-	29.62
Production	24.73	-	37.28	15.28	-	25.07
Land and Taxes	1.84	-	3.83	3.19	-	4.55
Transportation	17.45	-	24.60	13.14	-	21.00
Trucking	0.00	-	1.50	0.00	-	1.63
Rail Rate	0.00	-	18.15	0.00	-	0.00
Barge	0.00	-	4.85	4.50	-	6.75
Port Charges	1.65	-	3.10	1.56	-	2.36
Ocean Freight	4.80	-	9.50	7.00	-	12.50
Total Delivered Costs	44.02	-	65.71	34.83	-	50.62

Notes: Totals may not add because they represent costs at different mines. Cost components within a column may be from several different mines to illustrate the range of typical costs in the respective countries.

Figure 4.2

Case IV: Delivered Cost Components

(Zero Percent DCFROR)



and lower ocean transportation costs, the U.S. mines are located much further from tidewater and are disadvantaged by higher inland freight charges.

Case V: Japanese Thermal Coal Market

The Pacific Rim countries (Japan, Korea, Hong Kong, Taiwan, Singapore, etc.) make up one of the fastest growing markets for seaborne thermal coals. In 1990, these Pacific Rim countries imported more than 40 percent of the world's seaborne coal.[20] In 1992, Japan imported 44.4 Mmt of thermal coal. Japan's primary sources for this thermal coal were Australia, China and Indonesia. Indonesian coal imports into Japan increased to more than 5 Mmt in 1992. Existing Japanese powerplants are required to burn low-sulfur (maximum 1.2 percent sulfur) coals, but they can blend and burn higher sulfur bituminous coal, as well as low-sulfur subbituminous coals. Almost all Japanese electric powerplants are equipped with FGD and particulate control systems.

The Japanese thermal coal market imported 2.6 Mmt of U.S. coal in 1992. This is a relatively small market for U.S. coal exports that is primarily sourced from Uinta basin mines in Utah and Colorado. U.S. mines in Alaska, appalachia, and the State of Washington occasionally ship thermal coals to Japan.

Case IV uses three Indonesian mines from Cases I and II and three U.S. mines that are selling or have sold coal to Japanese powerplants. The Indonesian mines include three large surface mines that produce from 2 to more than 8 Mmt/yr of bituminous coal. These Indonesian coals require only crushing and partial washing to produce this thermal product. Combinations of truck, barge, conveyor, and/or rail transportation are used to move these coals to ports. These distances range from 12 to 450 km. The ocean shipping distance from east Kalimantan to Tokyo is approximately 5,000 km.

The three U.S. mines in this case are located in the States of Alabama, Kentucky, and Washington. Two of these mines are large underground operations that use longwalls, and one is a small surface operation that uses trucks and shovels. The annual production of these mines range from 0.3 to 3.0 Mmt/yr. All of these mines wash their coal with plant yields of 60 percent to 85 percent. Combinations of truck and barge transport are used to move these coals to export ports on the Lower Mississippi River, McDuffie Island, and Seattle. Inland transportation distances range from 55 to 3,600 km. Ocean distances range from approximately 9,000 to 18,500 km.

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[20] International Energy Annual 1991, Energy Information Administration, U.S. D.O.E., December, 1992, pp. 74-75.

Delivered Cost Comparisons and Findings

The delivered costs for the U.S. and Indonesian mines are shown in Table 4.3 and Figure 4.3. Delivered costs range from $29.94 to $44.62 per metric ton for the Indonesian coal mines and from $37.87 to $58.07 per metric ton for the U.S. mines. The Indonesian mines included in this case study show an $8 to $13 per metric ton delivered cost advantage over the U.S. mines. This competitive advantage is because of lower mine-mouth costs, lower inland transportation costs, and lower ocean transportation costs for the Indonesian mines.

The U.S. mines show a $1 to $2 per metric ton mine-mouth cost disadvantage when compared to the Indonesian mines. This cost disadvantage is influenced by the mining method (two of the U.S. mines are underground versus Indonesian surface mines), higher wage rates at U.S. mines, and higher preparation costs for the U.S. mines. Land costs are lower at the U.S. mines that own the coal in fee. Production taxes are higher at the U.S. mines.

Total transportation costs at the Indonesian mines are approximately $9 to $11 per metric ton lower than the U.S. mines. The U.S. mines are farther from tidewater and are disadvantaged by higher inland freight charges as well as much longer ocean shipping distances and higher ocean transportation costs.

Summary of Case Study Findings

The Indonesian coal mines included in this study are extremely competitive in Pacific Rim thermal markets. This coal is also competitive in European thermal markets but is not competitive in the U.S. Mississippi River thermal market. The Indonesian coals will capture market share from Australia and South Africa in the Pacific Rim markets and may gain market share from Australia, South Africa, and the United States in the European markets. Indonesian coals with extremely low sulfur levels may find niche environmental markets in the U.S.

Indonesia's competitive advantages include the following:

- Low mine-mouth costs
  - Low labor costs
  - Low stripping ratios
  - Economies of scale (large mines)
  - Lower production taxes
- Advantageous transportation costs
  - Mines are close to tidewater
  - Close to Pacific Rim markets
  - New ports that can load large vessels

TABLE 4.3
CASE V: DELIVERED COST SUMMARY
($/mt)

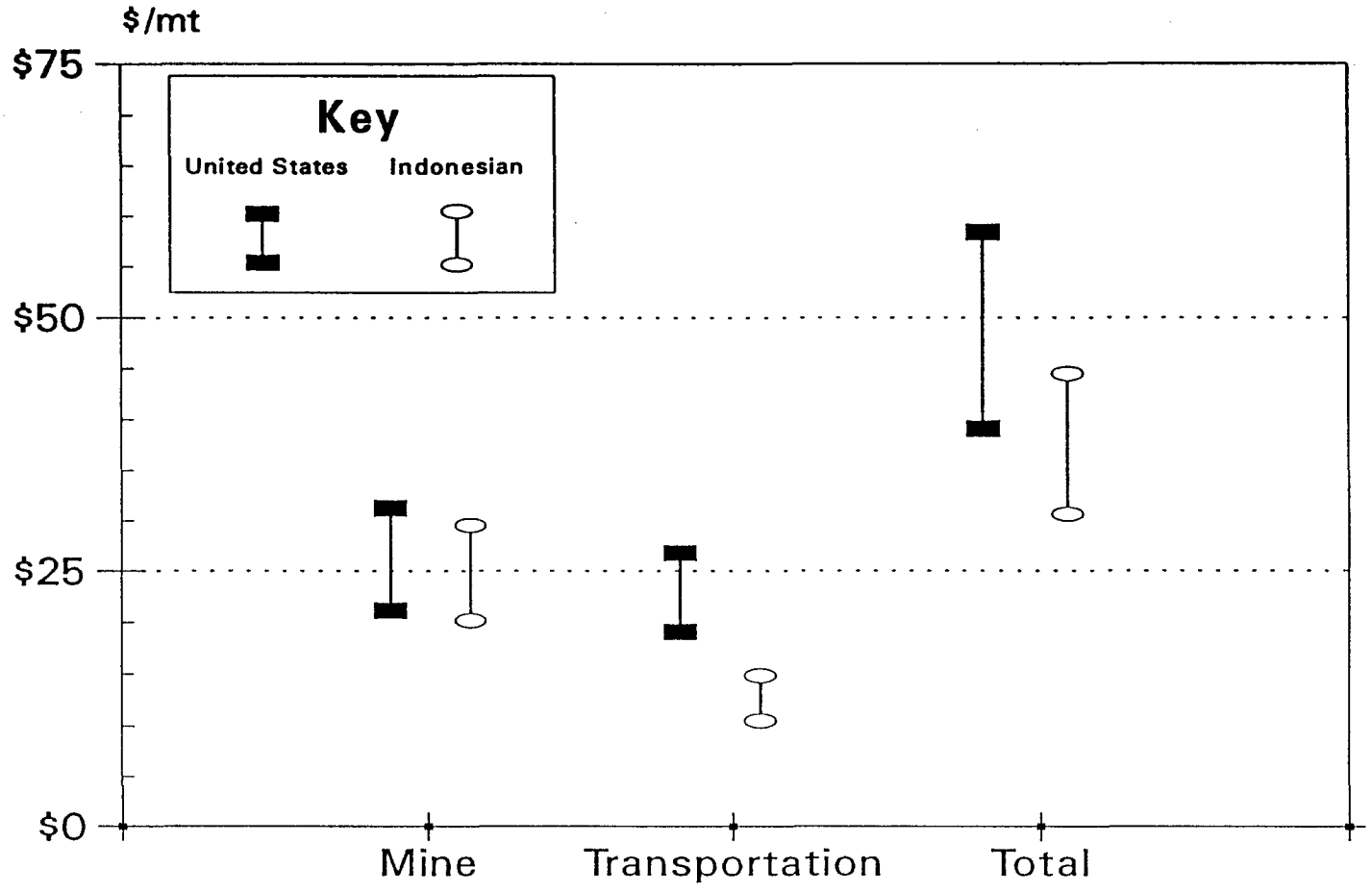
Cost Category at Zero Percent DCFROR	U.S. Range			Indonesian Range		
Total Mine-Mouth Cost	19.23	-	31.32	18.47	-	29.62
Production	15.88	-	29.36	15.28	-	25.07
Land and Taxes	1.84	-	3.35	3.19	-	4.55
Transportation	18.64	-	26.75	9.75	-	15.00
Trucking	0.00	-	5.51	0.00	-	1.63
Rail Rate	0.00	-	14.85	0.00	-	0.00
Barge	0.00	-	4.85	4.11	-	6.75
Port Charges	1.65	-	4.13	1.56	-	2.36
Ocean Freight	9.00	-	18.00	4.00	-	6.50
Total Delivered Costs	37.87	-	58.07	29.94	-	44.62

Notes: Totals may not add because they represent costs at different mines. Cost components within a column may be from several different mines to illustrate the range of typical costs in the respective countries.

Figure 4.3

Case V: Delivered Cost Components

(Zero Percent DCFROR)



- Good quality coals
  - Low sulfur
  - Low ash
  - Moderate to high calorific values

These competitive advantages in combination with the encouragement of the Indonesian Government and the efforts of the private coal contractors have helped propel Indonesia's remarkable growth as a coal exporter during the past decade. Indonesia's coal exports will continue to grow at a rapid rate as many of the current mines build to full capacity. Competitive pressures and experience gained at these grassroots projects will probably result in incremental production increases beyond current plans. A second generation of coal projects will result from Indonesia's recent tenders for 20 new coal blocks. These new projects will benefit from the exploration, infrastructure, and experience of the first coal contractors. Because of these benefits, some of these new projects could quickly begin coal production.

GLOSSARY

Abandoned Mine Lands Reclamation Fee - U.S. production tax used to reclaim abandoned coal mines and disturbed lands. Authorized as part of the Surface Mining Control and Reclamation Act of 1977.

Anthracite - Coal of very high rank that is characterized by low volatile matter content (less than 10 percent) and high fixed-carbon content. Anthracite has a semi-metallic luster, burns with little smoke, and has a high specific gravity.

Ash Content - The amount of inorganic residue remaining after the complete combustion of coal defined as a percentage by weight. For test procedure, see American Society of Testing and Materials (ASTM) specification D-3174.

Batubara - Indonesian word for coal. Sometimes used to refer to P.T. Tambang Batubara Bukit Asam (the Indonesian state coal mining agency).

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 D-388 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 dependents) afflicted with pneumoconiosis (which includes black lung) or other respiratory ailments contracted from prolonged exposure to dust laden atmospheres.

Blasting - The use of explosives loaded in drill holes to fragment rock or coal.

British Thermal Unit (Btu) - A Btu is equivalent to the quantity of heat required to raise the temperature of 1 pound of water by 1 degree Fahrenheit (1 Btu = 0.2520 kilocalories).

British Thermal Units Per Pound (Btu/lb) - A standard unit for measuring the specific quantity of heat energy contained in a fuel. A measure of caloric value (1 Btu/lb = 0.5556 kcal/kg).

Brownfield - A mining development or expansion that is able to utilize existing infrastructure. An incremental expansion.

Btu - British thermal unit.

Btu/lb - British thermal units per pound.

Bucket-Wheel Excavator - A large, continuous digging machine used to mine unconsolidated overburden and coal. A large, boom-mounted, rotating wheel with buckets on its perimeter scoops material from the bank and transfers this material to a conveyor belt. The excavated material may be transported over 10 km to dump sites by means of shiftable conveyor belts and stackers.

Capesize - Term used to describe oceangoing vessels with dimensions too large to pass through the Panama canal and therefore limited to routes around Africa or South America. Sizes for these capesize vessels can range from 110,000 to 250,000 deadweight tons (dwt).

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

Coal Deposit - A natural accumulation of coal in a specified area. Smaller in scope than coalfield or 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 Specification D-388).

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

Coke - Carbonized coal created by heating bituminous 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 Surface Miner - A crawler-mounted machine that fragments and loads coal into a truck though the use of a large rotating milling head and elevating conveyor. This is often a large version of an asphalt milling and reclaiming machine.

Contract of Work - The agreement between the Indonesian Government and foreign coal contractors that defines the rights and responsibilities of both parties. The contract of work (COW) typically defines taxation, royalties, import duties, Indonesian ownership, labor conventions, environmental regulations, etc.

Diapiric Dome - A dome structure that forms over a mobile core of plastic material (salt, mud, etc.).

DCFROR - Discounted cash flow rate-of-return. The discount rate that makes the discounted, after-tax value of operating income from a project equal to the discounted, after-tax value of all investments in the project.

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 - Meters of overburden covering the coal seam.

Dip - The inclination of coal seams and strata from the horizontal.

Dozer - A large crawler tractor equipped with a push blade.

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., labor force schedules) and input prices (e.g., wage rates) to all individual physical inputs to a production process.

Flue Gas Desulfurization - A process where oxides of sulfur in the exhaust gases from coal furnaces are absorbed by alkali reagents. The most commonly used process in the United States uses a slurry of limestone ($CaCO_3$) as an absorbent.

Fluidity - A measure of the softening characteristics of coal during coke making. Fluidity is measured using the Geiseler Plastometer, and the maximum fluidity is expressed in dial divisions per minute (ASTM Specification D-2639).

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.

Foreign Contractors - Non-Indonesian corporations that have contracted with the Indonesian Government (P.T. Batubara Bukit Asam) to develop and mine coal for a fixed percentage of the product tonnage. As of 1992, there were 10 foreign coal contractors in Indonesia.

Geared Vessel - A bulk cargo ship that is equipped with cranes and may be self-loaded. Typically handysize or smaller vessels.

Generating Unit - A furnace, turbine, generator and associated equipment at a thermal powerplant. A given powerplant typically consists of one or more generating units.

Greenfield - A mine development in an undeveloped region that cannot take advantage of existing infrastructure. A grassroots exploration project.

Grindability - See Hardgrove Grindability Index.

ha - Hectare.

Handysize - Oceangoing vessels of 40,000 dwt or less.

Hardgrove Grindability Index - A measure of the ease of pulverization of a coal. High values (greater than 50) indicate a coal that is easy to pulverize and low values (lower than 50) indicate a coal that is hard to pulverize (See ASTM Specification D-409).

Hectare (ha) - Unit of area. One ha = 10,000 square meters = 2.47 acres = 107,639.10 square feet.

Highwall - The unexcavated face of exposed overburden in a coal pit. Usually the uphill or deepest side of an open pit. The pit wall in the direction of advance in an open pit.

Hydraulic Excavator - An earthmoving machine that uses hydraulic pumps and cylinders to transfer power from a diesel engine or electric motors to the digging arm and digging implements. Hydraulic excavators may be configured as either shovels or backhoes.

Infrastructure - The transportation, communication, and support facilities needed to support the coal mining operations and shipment of the final product. As used in this report, infrastructure include any roads, railroads, airfields, ports, warehouses, electrical supply, communications, water, sewage facilities, housing, food-service, medical, teaching, and recreational facilities that are financed by the mining operation.

Interburden - Rock layers that separate coal seams .

kcal/kg - Kilocalories per kilogram.

Kilocalories/Kilogram - A measure of caloric value (1 kcal/kg = 1.8 Btu/lb).

km - Kilometer. 1 km = 0.6214 miles = 1,000 meters.

Lignite - A brownish-black coal of lower rank with high inherent moisture and volatile matter.

m - Meter. 1 meter = 39.37 inches = 3.281 feet.

Mafic Intrusion - A mass of dark igneous rock formed by the injection of basic magma into earlier formations.

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 use in blast furnaces.

Metric ton - 1 metric ton = 1.1 short tons = 2,204.62 pounds avoirdupois = 1000 kilograms (often referred to as tonne). Abbreviated as mt, Mmt = million metric tons, and Mmt/yr = million metric tons per year.

Mine-Mouth Cost - Total capital, operating, and other direct and indirect costs of raw coal, f.o.b. mine.

Moisture Content - A measurement of the amount of water present in coal at the time of sampling (ASTM Specification D-3302).

Motor Grader - A long earthmoving machine with a centrally mounted blade that is used to level and maintain roads.

mt - Metric ton.

Mmt - Million metric tons.

Mmt/yr - Million metric tons per year.

MW - Megawatts

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

Overburden - The rock and/or soils that overlay a coal seam.

Pacific Rim - Asian and Oceanic countries that border the Pacific Ocean. The Pacific Rim countries of importance to world coal trade include Australia, China, Hong Kong, Japan, Taiwan, and South Korea.

Panamax - Term used to describe oceangoing ships with dimensions that enable them to traverse the Panama Canal with maximum cargo loading possible.

Parting - Thin, horizontal clay, rock, or dirty-coal bands that occur within a coal seam.

Phase I and Phase II - See U.S. Clean Air Act Amendments of 1990.

Preparation - Processing of raw coal to produce a marketable product. Preparation may include crushing, sizing, and the separation of impurities from the raw coal.

Production Taxes - Taxes and fees that are levied on a tonnage basis. In the United States, these production taxes include Black Lung Tax, Abandoned Mine Lands Fee, Severance Taxes, etc.

Productivity - A measure of output per unit of labor. In the coal mining industry, this is usually measured in terms of metric tons per worker-hour, or the tonnage produced by the average miner during one hour.

P.T. Batubara - Former Indonesian state coal directorate. Became P.T. Tambang Batubara Bukit Asam in 1991.

P.T. Tambang Batubara Bukit Asam - Indonesian state coal directorate. Operates the Ombilin and Bukit Asam mines on Sumatra and administers the foreign coal contractors.

PTTBBA - P.T. Tambang Batubara Bukit Asam.

Quality - Refers to standard measurements of the physical and chemical properties of coal. Commonly used standards for internationally traded coals are ASTM and the International Organization for Standardization (ISO). The quality of a given coal will determine its applicability for various uses.

Rank - The rank of a coal indicates the degree of alteration or coalification of the original plant material. Higher rank coals contain lower amounts of moisture and higher levels of fixed carbon. Higher rank coals usually have higher heating values. Rank affects many of the chemical and physical properties of a coal that influence its applicability for various commercial uses (see ASTM Specification D-388).

Rate of Return - The discount rate that will yield a net present value of zero for a given cash-flow stream. Referred to as the rate of return (ROR), discounted cash-flow rate of return (DCFROR), and internal rate of return (IRR).

Raw Coal - Coal that has not been washed.

Reactivity - Self-heating potential of a coal sample. A measure of the potential for spontaneous combustion.

Reclamation Bond - Monies that are put in escrow to cover reclamation costs in the event that the mine operator defaults on his reclamation obligations. In most states, this bond is based on disturbed acreage and/or reclamation cost estimates.

Reclamation Tax - The Abandoned Mined Lands Tax imposed by the U.S. Federal Government (Surface Mining Control and Reclamation Act of 1977) to aid in the reclamation of abandoned mined lands.

Recovery Factor - The percentage of recoverable coal versus the in situ reserves in a given area.

Reserve - That portion of an identified coal resource that is estimated to be recoverable with the technology and prices prevailing at the time of determination.

Ripper - A long pick attached to the rear of a crawler tractor that is used to break weak rocks and indurated soils. A ripper is commonly used instead of blasting.

Ripping - The process of fragmenting rock with a ripper.

Road-Train - Two or three bulk trailers that are hauled by a single truck tractor.

Rotary Drill - A truck- or crawler-mounted machine that drills large-diameter holes in overburden or coal using tri-cone or drag bits. These holes are loaded with explosives to fragment the material.

Royalties - Payments to the owner of coal and/or surface rights for the opportunity to mine.

Royalty-In-Kind - Royalty that is paid with a portion of the production. Sometimes called a production sharing royalty or production sharing agreement.

Run-of-Mine - Coal extracted from the seam before it is crushed, sized, and/or washed.

Rupiah - Indonesian currency (Rp).

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

Shovel - A large, electric-powered mining excavator that uses wire rope cables to lift a stick-mounted bucket.

Spontaneous Combustion - Self-heating and possible ignition of coal caused by local oxidation. Spontaneous combustion is more common in subbituminous and lignitic coals because of the vast internal pore space that is exposed as these high-moisture coals dry out. Coals with spontaneous combustion potential present a particular problem in storage and transport, particularly in bulk ocean carriers.

Steam Coal - See Thermal Coal.

Strippable - Coal resources/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. Expressed as bank cubic meters of overburden per metric ton of coal (BCM/mt). 1 BCM/mt = 1.19 bank cubic yards per ton.

Subbituminous Coal - A dull black, solid fossil fuel ranking between lignite and bituminous coal.

Subcrop - A buried discontinuation of a coal seam that is caused by weathering.

Sulfur Content - The percentage of total sulfur, on a weight basis, that is contained in coal (ASTM Specification D-3177).

Thermal Coal - Coal used by electric power utilities and industrial consumers to produce heat. Typically used in thermal electric power generation (also referred to as steam coal).

Unit Train - A dedicated train set that is used to transport coal from the loading point to the destination without having to break up the cars. A unit train typically consists of 80-110 cars and up to 6 locomotives in the United States.

U.S. Clean Air Act Amendments of 1990 - Amendments to the U.S. Clean Air Act. These amendments require the 111 U.S. coal-fired generating units that emit the most sulfur dioxide (SO_2) to reduce their average SO_2 emissions to less than 2.5 pounds of SO_2 per million Btu of heat input by 1995 (Phase I). By the year 2000, almost all generating units must emit less than 1.2 pounds of SO_2 per million Btu of heat input (Phase II).

Volatile Matter - The loss of mass, excluding moisture that occurs when coal is heated under standard conditions without contact with air. Volatile matter is an indicator of the off-gas from the coke making process and is related to coal rank. (ASTM Specification D-3175).

Washing - Using water-based methods to separate impurities from raw coal. Separation methods include heavy media, jigs, cyclones, spirals, and froth floatation.

Waste - The broken overburden material in an open pit coal mine.

Waste Dump, Waste Pile - A pile of broken overburden material in an open pit coal mine.

Wheel Loader - A rubber-tired tractor equipped with a front-mounted bucket. Used to excavate fragmented or unconsolidated materials. Often used for stockpile reclamation and utility cleanup.

APPENDIX A

INDONESIA COAL MINING TAXES AND ROYALTIES

There are different tax regulations for each of the primary coal production entities in Indonesia: the Government mines, the cooperative coal contractors, and the private Indonesian coal mines. Since the coal contractors are the primary coal exporters (over 80 percent of all exports in 1992), this study will concentrate on the taxes and royalties that apply to these coal contractors. These coal contractors are subject to the taxes and royalties that are enumerated in the Contract of Work Agreements (COW). The Contracts of Work that were negotiated between P.T. Tambang Batubara Bukit Asam (PTTBBA) and the coal contractors are broad instruments that specifically define the rights; obligations; term; taxation; royalties; import and export duties; use of Indonesian work force; and many other issues that govern the exploration, development, and operation of coal mines in Indonesia. Although each COW contains different specifics as the results of individual negotiations between PTTBBA and the coal concessionaires, there are some common elements in the various COWs, particularly in the areas of taxes and royalties. The tax and royalty regulations that are described in this section are representative of the 10 current COWs, but specific exceptions do occur. The tax treatments and royalty agreements specified in the COW are fixed for the term of the COW (typically 30 years of production).

Income Tax

COWs negotiated before 1984 provide coal producers a reduced tax rate for the first 10 years following commencement of commercial coal production in addition to a 25 percent capital investment allowance. This reduced income tax rate is 35 percent of taxable income during the first 10 years of commercial coal production. After the first 10 years of coal production, the income tax rate for the remaining years of coal production is 45 percent. The typical COW also provides for a capital investment allowance of 25 percent. This capital allowance is deductible from taxable income during the first 4 years of an asset's life.

For COWs issued after 1984, ordinary Indonesian corporate tax rates apply. These "Fourth Generation" COWs do not contain the tax preferences for the mining industry that were included in earlier COWs. The normal corporate income tax rates are 15 percent for taxable income of Rp 10 million or less, 25 percent for the next Rp 40 million, and 35 percent for taxable income over Rp 50 million. The 25 percent capital investment allowance is not included in "Fourth Generation" COWs.

Taxable income is defined as gross income received during the tax year less all expenses and costs incurred during the tax year that are permitted by the agreement or by Indonesian tax laws.

Deductible operating expenses are attributable to the production of coal, including costs of materials, supplies, equipment, and utilities; cost of contracted services; insurance premiums; losses or damages not reimbursed by insurance; royalties, rents, sales tax, stamp duty and other levies; costs associated with coal processing and treatment; costs of handling, loading, storing, transporting, and shipping; cost of repair and maintenance; cost of commissions and discounts; depreciation and amortization; and general administrative costs.

Depreciation of assets is determined according to the straight line method at an annual rate of 12.5 percent (8-year straight-line depreciation). A capital investment allowance may be applied to buildings and other assets. Buildings qualify for a 10 percent investment allowance that may be applied to 1 year of the first 4 years of the asset's life; other assets qualify for a 25 percent investment allowance that may be applied in one of the first 4 years of the asset's life. A deduction for amortization of all expenses incurred prior to production is determined according to the straight line method at the rate of 12.5 percent per year. Preproduction expenses that are eligible to be amortized are surveying, exploration, development, employee training, education, and grants. The post-1984 COWs are subject to different depreciation schedules and methods.

Net operating losses incurred during the first 5 years of production can be deducted from net income in succeeding years for an indefinite period of time. After the fifth year of operation, any net operating losses may be deducted from the net income of the operation for a period of 4 years. Contractors must submit withholding taxes on employees salaries and on dividends, interest, royalties paid, and other payments including fees for technical assistance at the rate of 10 percent.

Other Taxes

Contractors must pay a Regional Development Tax, which is payable annually in a lump sum of U.S.$100,000. Indonesia levies no production taxes on coal. Contractors are specifically exempted from other Indonesian taxes, both present and future, and duties, rentals, and royalties assessed by the Government. Included under the exemption are transfer taxes; import and export duties on materials, equipment, and supplies; and taxes on capital, net worth, operations, and remittances or transactions. The coal contractors are also exempted from value-added tax (VAT) on export sales. In order to support the duty-free import of mining equipment and supplies, all mining equipment and inventories become the property of PTTBBA when landed in Indonesia.

Royalties

The basis of the typical contract of work is a production-sharing agreement where PTTBBA receives a portion of the concessionaire's

production in exchange for the right to mine and sell the remainder. PTTBBA then brokers its share of the coal production to both foreign and domestic concerns. The typical COW stipulates that PTTBBA shall receive 13.5 percent of the coal product F.O.B. in vessels of its choice. Some COWs allow PTTBBA to chose between the actual coal tonnage and 13.5 percent of gross sales. The P.T. Allied Indo COW gives PTTBBA 20 percent of the coal product because of the use of Ombilin infrastructure. These production sharing agreements are royalties-in-kind arrangements. Some COWs include a minimal acreage-based rental fee for the mining area in lieu of local property taxes. Compensation must be paid to any occupants of these lands that are displaced by the mining operation. This compensation is based on a schedule that addresses buildings, improvements, and crops.

APPENDIX B

U.S. FEDERAL AND STATE TAXES, ROYALTIES AND BONDING REQUIREMENTS FOR COAL MINING OPERATIONS

U.S. Federal Taxes

The U.S. Federal Government levies numerous taxes and fees on coal operations. These taxes and fees include the following:

- Income tax
- Production taxes:
  - Black Lung Tax
  - Abandoned Mine Lands Fee
- Employment taxes:
  - Social Security
  - Medicare
- Production royalties (only on Federal lands)
- Bonus bids and lease fees (only on Federal lands)

These taxes and fees are in addition to State and local taxes and fees.

U.S. Federal Income Tax

Federal Income Tax Rate

The U.S. Federal corporate income tax is a graduated rate with a maximum of 34 percent on taxable income of more than $335,000. Taxable income between $100,000 and $335,000 is taxed at the rate of 34 percent plus an additional 5 percent.

Although the U.S. Federal income tax is graduated to ease the tax burden of smaller companies, all of the U.S. coal mines that were examined in this study were owned by large, profitable corporations. As such, any profits from these mines were effectively taxed at the highest corporate income tax rates.

Taxable Income

Mining companies, for purposes of determining Federal taxable income, are permitted to deduct from revenues all operating costs and capital costs relating to interest on debt, as well as depreciation on equipment and real property, and percentage depletion. Operating costs include mining and processing costs, marketing and transportation costs, exploration, certain development costs, property taxes, production taxes, royalties, and general administrative charges.

Depreciation

Depreciation is a systematic deduction from taxable income that represents the deterioration and obsolescence of equipment and buildings used in producing income. Depreciation of capital property is limited to equipment that has a useful life of greater than 1 year. Equipment that has a useful life of less than 1 year is expensed as an operating cost. Depreciable property is further classified as real or personal property. Real property is land and anything that is erected on or attached thereto. At coal mines, real property includes preparation plants, silos, offices, shops, warehouses, etc. Personal property is property other than real property and includes machinery and equipment. Property is considered to be depreciable if it meets the following criteria:

1. It must be used in business or held for the production of income.
2. It must have a useful life that can be determined, and this useful life must be greater than 1 year.
3. It must be something that wears out, becomes obsolescent, or loses value.

Thus, land is not depreciable because it has an infinite life. Coal reserves are not depreciated but are addressed by the depletion deduction. Depreciation may not be claimed until the property begins production.

Expenditures for mining equipment and development that are required to maintain normal production levels because of the changing location of the mining face may be expensed in the year incurred rather than depreciated even though these items have useful lives greater than 1 year. This is known as the receding face theory and is applicable to haul roads, conveyors, shafts, slopes, ventilation equipment, etc.

The Tax Reform Act of 1986 established the Modified Accelerated Cost Recovery System (MACRS) that is currently in force. Under MACRS, the depreciable life of mining equipment was set at 7 years. Double declining balance depreciation switching to straight-line depreciation may be used for mining equipment. Over-the-road trucks and light vehicles have a recovery period of 5 years. In the case of 15- and 20-year property, a 150 percent declining balance method is used. For non-residential real property, which has a recovery period of 31.5 years, the straight-line depreciation method applies. A half-year convention is required for all assets under MACRS.

Depletion

The depletion allowance is a method that allows a mineral producer to recover the cost of the ore body as it is mined. This cost includes the purchase price of the property (if any) and exploration costs. These costs form the basis of cost depletion and are usually amortized over the life of the mine using unit-of-production methods. In order to stimulate mineral

production and to address some of the unique risks associated with the minerals industry, percentage depletion (statutory depletion) was introduced in 1926. Percentage depletion for coal and lignite mines under the U.S. Code in 1988 was 10 percent of gross revenues less royalties. However, for tax years beginning after 1986, the percentage depletion deduction for coal was reduced by 20 percent after recovery of the cost basis of the mine, resulting in an effective corporate percentage depletion rate of 8 percent. The depletion rate is applied to the gross income from the property excluding from such gross income an amount equal to any rents or royalties paid or incurred by the taxpayer in respect to the property. The percentage depletion allowance may not exceed 50 percent of the taxpayer's taxable income from the property, computed without allowance for depletion (see Figure B.1).

For corporations subject to the reduced (by 20 percent) percentage depletion rate for coal, only 71.6 percent of this preference before such reduction is to be included in the minimum tax base for calculating alternative minimum tax.

Alternative Minimum Tax

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 corporate taxpayer's alternative minimum taxable income, calculated by adjusting Federal taxable income, adding preference items, and deducting an exemption of $40,000. The exemption amount is reduced by 25 percent of the alternative minimum taxable income exceeding $150,000. The exemption amount is reduced to zero for alternative minimum taxable income in excess of $310,000. Preference items are the excess of percentage depletion in excess of cost depletion and the excess of the 200 percent declining balance depreciation over that of the 150 percent declining balance method switching to the straight-line method.

Foreign Corporations

Foreign corporations are subject to a withholding tax of 30 percent, except those corporations engaged in trade or business within the United States, in which instance the foreign corporation is subject to the same corporate taxes as domestic corporations.

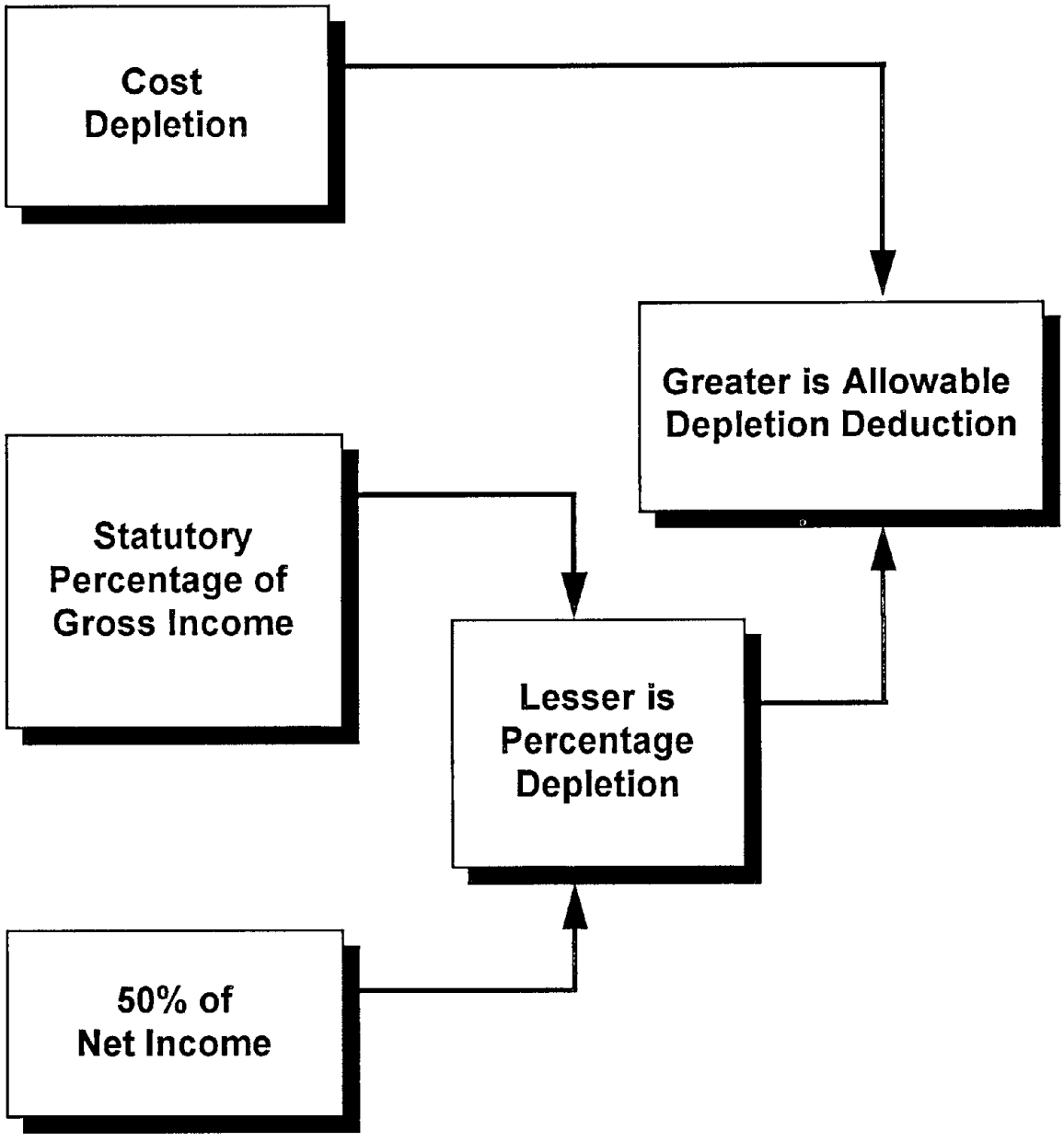
Other U.S. Federal Taxes

Social Security

The Social Security withholding rate for employers is 6.2 percent of employees' wages. The tax is limited to the first $55,500 of an employee's wages earned in 1992. The withholding rate for

Figure B.1

U.S. Federal Depletion Deduction



Medicare is 1.45 percent of employees' salaries. The tax is limited to the first $130,200 of an employee's wages earned in 1992.

Black Lung Tax

The Federal Government levies a special excise tax on every ton of coal mined 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 (Black Lung) and other industrial respiratory diseases caused by the inhalation of coal and rock dust. This fund was established to compensate those miners suffering as a result of these occupational health hazards. Initially, this tax was the lesser of 4 percent of the sales price of the coal or $1.00 per short ton for underground mined coal or $0.50 per short ton for surface mined coal. Public Law 99-514 raised the level of payments to this fund, beginning April 1, 1986, to $1.10 per short ton of coal mined underground and $0.55 per short ton of coal from surface mines. However, the amount of tax may not exceed 4.4 percent of the price sold by the producer. Lignite is exempt from the tax.

Abandoned Mine Lands Reclamation Fee

The Surface Mining Control and Reclamation Act of 1977 included the Abandoned Mine Lands Reclamation Fee. The fund is used primarily for the reclamation of land and water resources adversely affected by past coal mining. The fee is set at $0.35 per short ton of coal produced by surface coal mining and $0.15 per short ton 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 shall be at a rate of 2 percent of the value of the coal at the mine or $0.10 per short ton, whichever is less. Proceeds go into the Abandoned Mine Reclamation Fund, administered by the Secretary of the Interior.

Federal Coal Royalties

Coal mines located on Federal lands are also responsible for the lease rental on the acreage mined including a lease bonus bid. Recent lease bonus bids have been from $0.16 to $0.41 per short ton of reserves. In addition to annual rents and bonus bids, coal producers must pay a royalty of 12.5 percent of gross revenues for surface mined coal and 8 percent of gross revenues for underground mined coal.

Environmental and Reclamation Regulations

The Surface Mining Control and Reclamation Act of 1977 (SMCRA - P.L. 95-87) was enacted to ensure the adequate reclamation on all areas disturbed by surface coal mining operations. At the time of its passage, many abandoned, unreclaimed surface and

underground mines existed in the United States and posed both health and safety hazards to surrounding communities, as well as being unsightly reminders of irresponsible attitudes toward the environment.

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 States' 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 which 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.

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 post-mining land use. States are not required 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, as well as provisions that the operator 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.

An administrative completeness review fee of $250, a $2,000 decision document fee, and a technical review fee of $1,350 are applied to all new permit applications. An additional sliding scale acreage fee is charged at the rate of $13.50 per acre for the first 1,000 acres, $6.00 an acre for the second 1,000 acres, $4.00 per acre for the third 1,000 acres, and $3.00 per acre for every acre in addition to the first 3,000 acres.

Alabama State Taxes

State Corporate Income Tax

Federal taxable income is not used as the basis for State income tax calculation. Alabama allows Federal depreciation deductions but does not allow Federal depletion. Federal income tax is deductible for State tax purposes.

Corporate income tax is 5.0 percent of taxable income. Net income is gross income less allowable deductions for 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" allowances for depreciation and cost depletion, charitable contributions, contributions to employees trust or annuity plan, and investments in pollution control devices. There is a 15-year net operating loss carry forward, but no carry back is allowed.

Other State and Local Taxes

Severance Taxes

Excise and privilege tax on coal severed in Alabama is $0.15 per metric ton. In addition to the coal excise and privilege tax, every person severing coal or lignite is subject to a severance tax of $0.22 per metric ton of coal or lignite. The total effective severance tax is $0.37 per metric ton.

Property Tax

Mine property, classified as Class II property, is assessed at 20 percent of fair and reasonable market value. Market value of land and aboveground improvements is based on the depreciated cost method. Equipment is assessed on the reported value. The State property tax rate is 0.65 percent. The 1992 county property tax rate is 2.0 percent.

Sales and Use Tax

Alabama has a gross receipts sales tax of 1.5 percent on machines and parts used in mining and quarrying. The general sales and use tax rate is 4.0 percent of gross receipts from retail sales of goods and services. The county has sales and use taxes which

are not administered by the State of Alabama. The county general sales and use tax rate is 2.0 percent and the motor vehicle tax rate is 0.5 percent. These taxes are assigned to capital costs for the purchase of mine equipment and operating costs for repair parts.

Corporate Franchise (License Tax)

Alabama applies a corporate franchise tax on domestic and foreign corporations. Domestic corporations are taxed on the amount of capital stock, and foreign corporations are taxed on that portion of total capital employed in Alabama. Foreign capital includes outstanding capital stock, surplus and undivided profits, bonds, notes, and other evidence of indebtedness. The rate of tax for domestic corporations is $10 per $1,000 of capital stock; the minimum tax is $50. Foreign corporations are taxed $3 per $1,000 of capital employed in Alabama or a minimum of $25. All corporations must file an annual report. The annual report fee is $10.

Domestic and foreign corporations also pay an annual corporation permit fee on the basis of the corporation's paid capital stock. Domestic fees range from $10 to $100 per year, and foreign fees range from $5 to $100 per year.

Unemployment Insurance

The maximum unemployment insurance tax rate for employers is 6.04 percent of wages; the minimum rate for an employer with a positive balance is 0.44 percent. The rates do not include the 1993 special assessment of 0.06 percent and shared cost assessment of 0.09 percent. Employers with sufficient experience in the mining industry may qualify for an experience rating. The State's absolute minimum is 0.20 percent. The taxable basis is limited to the first $8,000 of an individual's yearly wages. The State provides for an increase of the taxable limit in the event that the Federal taxable limit is set at a higher rate than that of the State. Voluntary contributions are not permitted.

Workmen's Compensation

Coal producers can obtain workmen's compensation insurance through several insurance companies or through the National Council on Compensation Insurance. Insurance company rates vary for individual coal producers. The National Council on Compensation Insurance has an assigned risk plan for coal producers. The assigned risk rate for surface mines is $11.21 per $100 of payroll; the rates for underground coal mines are $21.95 for traumatic coverage and $13.08 for disease coverage, or a total of $35.03 per $100 of payroll.

Reclamation and Bonding

Permit and Application Fees

Permits are required of all domestic and foreign corporations. The permits must be renewed annually. The fees range from $10 to $100 for domestic corporations and from $5 to $100 for foreign corporations. Fees are based on the amount of corporate capital assets employed within the State. Mining license applications must be submitted to obtain a mining permit from the State. The mining license fee is $1,000. There is also a $25 fee per acre. A reclamation performance bond is also required to obtain a mining permit.

Reclamation Bonds

Alabama requires that reclamation bonds be set at a minimum of $10,000. The total bonding requirement is set by officials of the State of Alabama's Environmental Management Department. The bond 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 that 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.

Kentucky State Taxes

State Corporate Income Tax

Kentucky State taxable income is determined according to Federal taxable income regulations. Federal income tax paid is not deductible for State tax purposes. If a corporation does not claim any Federal deduction for percentage depletion, 50 percent of gross income earned from sales of coal is excluded from the income tax base. Corporations may elect the Federal modified accelerated cost recovery system to depreciate assets placed in service after December 31, 1989. The 1993 tax schedule has graduated rates based on the varying levels of annual taxable income:

Taxable Income	Tax Rate
$0 - $25,000	4.00%
$25,001 - $50,000	5.00%
$50,001 - $100,000	6.00%
$100,001 - $250,000	7.00%
$250,000 +	8.25%

Other State and Local Taxes

Property Tax

All real and personal property--tangible and intangible--are taxable unless exempt. Machinery and products used in the process of manufacturing, including raw materials on hand, and air, water, or noise pollution control facilities, are subject to State property tax only. All property is assessed at its fair cash value. The State tax rate which is applied to the value of real property is $0.18 per $100 of assessed value; the State tax rate for tangible personal property is $0.45 per $100. The real property tax rate for county #1 is $0.66 per $100 of assessed value. The tangible personal property tax rate for county #1 is $0.67 per $100. The real property tax rate for county #2 is $0.53 per $100 of assessed value, and the tax rate for tangible personal property for county #2 is $0.56 per $100 of assessed value.

Ad Valorem Property Tax

Producing coal properties are valued at $0.58 per minable acre-inch. Non-producing coal properties that have been permitted are valued at $0.22 per minable acre-inch, and coal in place that has not been permitted is valued at $0.18 per minable acre-inch. Unmined coal is subject to State tax only. The State tax rate for unmined coal is $0.189 per $100 of assessed value. The county real property tax rate is applied to the assessed value of producing and non-producing permitted coal properties.

Severance Tax

Severance tax is imposed on gross value of all coal severed and/or processed. Gross value is the amount received for severed or processed coal. For coal not sold, the value is determined by contract price or fair market value for grade and quality of coal. Tax rate is 4.5 percent of gross value. The minimum severance tax is $0.50 per short ton of coal severed.

Sales and Use Tax

Sales and use taxes are imposed at the rate of 6 percent on gross receipts from retail sales of personal property. Coal used to produce electricity and fuel used in manufacturing are exempt from sales tax.

Corporate Franchise (License Tax)

A corporate license tax assessed on foreign and domestic corporations is based on the total capital employed in the business. The amount of capital employed in the State is determined according to liability and equity listed on the corporate balance sheet at the end of the accounting period. Capital consists of issued and outstanding capital stock, surplus, advances by affiliated companies, intercompany accounts, borrowed money, or any other accounts representing additional

capital used and employed in business. Corporations having gross income of not more than $500,000 receive a credit of $1.40 per $1,000 of the initial $350,000 of capital employed in the business. The tax rate is $2.10 per $1,000 of capital. There is a minimum tax of $30.

Unemployment Insurance

The State of Kentucky has a minimum rate of 0.30 percent for unemployment insurance. The State may make voluntary contributions to the State unemployment fund. The insurance rate is applied to the first $8,000 of an employee's wages. New employers with insufficient experience to qualify for a rating must contribute 3 percent of employees' wages.

Workmen's Compensation

Kentucky's Worker's Compensation Insurance Plan provides coverage for both traumatic and disease risks. The applicable rate varies with the type of mine, mine size and accident history. Larger companies may also elect self-insurance.

Reclamation and Bonding

Permit/Application Fees

A minimum annual licensing fee is $125 for surface coal mines. There is an additional fee of $25 for each 100,000 short tons of coal in excess of 100,000 short tons of surface mined coal produced in a calendar year. The maximum license fee is $1,000. The annual license fee for an underground coal mine with 1 working section is $125, with an additional fee of $25 for each additional working section. The maximum license fee is $1,000.

Reclamation Bonds

The minimum reclamation bond is set by law at $10,000, unless the operator is covered by the Kentucky bond pool, an alternative bonding option. Single or incremental bonding methods may be used. The bond must cover the entire permit area and it must continue for at least 5 years past the date of final reclamation activities. The total bond amount is based on the estimated cost of reclamation submitted by the operator plus additional costs that may be incurred by the State if it is forced to do the reclamation work. There is a reclamation processing fee of $375.

Surety bonds, collateral bonds, or a combination thereof are acceptable, provided that State regulations on bonding are followed and the that form of the performance bond is approved by the State Natural Resources and Environmental Protection Cabinet. Collateral bonds, such as certificates of deposit or letters of credit, must be in accordance with established regulations.

Alternative bonding is available through the Kentucky bond pool. Applicants are not automatically admitted to the pool; they must be accepted to the bond pool after they are screened for financial stability and past reclamation performance. Initial membership fees range from $1,000 to $2,500 depending on the rating of the applicant. The pool members must meet certain reporting requirements. Bonding requirements for the area are met using fees based on the tonnage of coal produced; the fees are $0.08 per short ton of surface-mined coal and $0.01 per short ton of coal mined by underground methods. Tonnage fees may be suspended if the pool fund reaches specified levels and individual members have made the required number of payments.

New Mexico State Taxes

State Corporate Income Tax

New Mexico State taxable income is based on the Federal taxable income. Federal depreciation and depletion are allowable deductions, but Federal tax is not allowed as a deduction from gross income. The corporate tax rate is a sliding scale of 4.8 percent for income less than $500,000, 6.4 percent for income of $500,001 to $1 million, and 7.6 percent for income in excess of $1 million.

Other State and Local Taxes

Severance Tax

An excise tax is imposed on taxable value of coal at the time of sale or transportation of the coal out of State. The rate per short ton of surface-mined coal is $1.17; the rate for underground coal is $1.13 per short ton. The severance tax rate includes a surtax of $0.60 for surface coal and $0.58 for underground coal. The surtax is calculated annually to adjust for inflation.

A resource or processor's tax is assessed on the taxable value of natural resources severed or processed in New Mexico. The rate is 0.75 percent of the taxable value of coal. A conservation tax of 0.18 percent is also assessed on the taxable value of coal.

Property Tax

All real and personal property is valued at market value and assessed at one-third of the market value. Mineral property, which includes reserves, mineral lands, interests, and severed mineral products, is valued at 300 percent of the net annual production value and assessed at one-third of the value. The 1992 county property tax rate was 2.25 percent.

Sales Tax

The sales tax is applied to gross receipts from retail sales at the rate of 5 percent. Counties and municipalities are authorized to impose sales excise taxes. The combined State and county sales tax is 5.6 percent.

Corporate Franchise (License Tax)

Domestic and foreign corporations that are franchised within the State or engaged in income-producing activities within the State are subject to a franchise tax. The annual rate of tax is $50. Every nonexempt domestic and foreign company must file a biannual report. The biannual report filing fee is $20.

Unemployment Insurance

Employers having a negative balance in the State unemployment account contribute 5.4 percent of taxable wages to the State unemployment fund. Employers having a positive balance contribute from a minimum of 0.6 percent to a maximum of 3.6 percent of their taxable wages. The rates include any applicable subsidiary and penalty rates. The unemployment taxable wages are limited to the first $12,100 of an employee's wages. Employers with sufficient experience in the mining industry may qualify for an experience rating. The State's absolute minimum rate is 0.1 percent. Employers may make voluntary contributions to the unemployment fund.

Workmen's Compensation

Employers may either provide unemployment insurance by purchasing an insurance policy or by contributing to an individual fund set up for their own employees. The rate of contribution is determined according to previous compensations paid to employees in the mining industry. For surface mining, the rate for assigned risk pools is $5.33 per $100 of payroll. Coverage for State benefits only is $2.09 per $100 of payroll, and coverage for Federal benefits only is $1.06. The voluntary market rate is $3.95 per $100 of payroll, $0.78 for Federal benefits only, and $1.50 for State benefits only. There are no underground insurance rates.

Reclamation and Bonding

Permit/Application Fees

The New Mexico Bureau of Permitting issues mining permits. The annual fee for the permit is $1,000 plus an additional $15 per acre.

Reclamation Bonds

Reclamation bond amount is determined according to the number of acres disturbed, depth of the pit, volume of material, top dressing, and permanent seeding. The bond amount is $1,000 plus

$10,000 per each acre disturbed. Minimum amount of bond is $10,000.

Washington State Taxes

State Corporate Income Tax

There is no Washington State income tax.

Other State and Local Taxes

Severance Tax
There is no severance tax on the production of coal.

Business and Occupation Tax
A business and occupation tax is assessed on the value of production plus the value of any byproducts. The rate of the business and occupation tax for the mining industry is 0.48 percent. A tax credit in the amount of the occupation tax paid is available for producers extracting coal sold in Washington State.

Property Tax
All real property and tangible personal property are subject to property tax. Property is assessed at 100 percent of fair cash value. The county property tax rate is 1.2 percent. Coal mineral rights are valued at $2.00 per acre. The property value on the portion of land being mined is $4,500 per acre.

Sales and Use Tax
All retail sales of tangible personal property and services, unless exempt, are subject to a retail sales tax. The rate of sales tax is 6.5 percent. A tax exemption is available for sales made to nonresidents of goods used outside the State.

Corporate Franchise (License Tax)
An annual license is required of every foreign and domestic corporation operating within the State of Washington. The annual license fee is $50 for foreign and domestic corporations. Foreign and domestic corporations must also file an annual report. The annual filing fee is $10.

Unemployment Insurance
The maximum unemployment insurance tax rate for employers is 5.4 percent; the minimum rate for employers is 0.48 percent. The rates include any applicable subsidiary and penalty rates. In

addition to the unemployment rates, there is a 0.02 percent rate for the State Employee Assistance Program. Employers with sufficient experience in the mining industry may qualify for an experience rating. The taxable basis is limited to the first $18,500 of an individual's yearly wages. Voluntary contributions are not permitted.

Workmen's Compensation

The composite rate for Workmen's Compensation insurance paid by coal mining operators is $2.62 per employee hour worked. The rate is multiplied by the total number of employee hours worked during a calendar quarter.

Reclamation and Bonding

Permit/Application Fees

The State of Washington requires mining companies to obtain a mining permit. The annual fee for the mining permit is $250.

Reclamation Bonds

The State of Washington does not have an approved reclamation bonding program. Reclamation bonding is administered by the Office of Surface Mining (OSM). Bonding requirements are governed by Public Law 95-87, Surface Mining Control and Reclamation Act of 1977. OSM currently requires a minimum bond amount of $10,000. The average amount of bonding for active coal mines in the State was $31,695,100.

Wyoming State Taxes

State Corporate Income Tax

There is no corporate income tax in Wyoming.

Other State and Local Taxes

State Severance/Business Occupation Tax for Coal

The basis of the State severance tax is the gross value of the coal extracted. The point of determination is the mine-mouth or the top of the ramp exiting the pit. The taxable value is the sales price less royalties paid to Federal, Indian, or State Governments. The applicable severance tax rates are 5.25 percent for coal recovered by underground mining and 8.5 percent for coal recovered by surface mining. For coal sales agreements negotiated between March 31, 1987 and March 31, 1995, the coal is exempt from any coal severance tax in excess of $0.80 per short ton of coal sold.

Property Tax
All lands for mines or mining claims are exempt from property taxes. Property tax is based on the counties' assessed value of all buildings and equipment. Industrial assets, including mining equipment, are assessed at 11.5 percent of fair market value and other property is assessed at 9.5 percent of fair market value. The 1992 property tax rate for county #1 was 6.0 percent. The 1992 property tax rate for county #2 was 6.3 percent.

Ad Valorem Property Tax
The gross mineral and mine products tax (ad valorem tax) is assessed in lieu of property tax on mining lands. The basis of the tax is 100 percent of the gross value of the coal as determined for severance tax purposes. The tax rates are the same rates as those used to determine property taxes.

Sales and Use Tax
A sales and use tax is imposed on retail sales based on gross receipts from retail sales at the rate of 3 percent. Counties impose an additional 1 percent sales and use tax on the same items subject to the State sales and use tax.

Corporate Franchise (License Tax)
An annual license tax is assessed on domestic and foreign corporations having the right to do business in Wyoming on the basis of the corporation's property and assets located and employed in Wyoming. The rates range from $10 to $50 for assets valued at less than $500,000. A rate of $100 is assessed for assets valued at more than $500,000 but less than $1 million. An additional $100 is assessed for every $1 million worth of assets, or fraction thereof.

Unemployment Insurance
The maximum unemployment insurance tax rate for employers is 9.52 percent; the minimum rate for an employer with a positive balance is 1.02 percent. The rates include any applicable subsidiary and penalty rates. Employers with sufficient experience in the mining industry may qualify for an experience rating. The State's absolute minimum is zero percent; however, the effective minimum rate is greater than zero percent because of State adjustments and surtaxes. The taxable basis is limited to the first $10,900 of an individual's yearly wages. Voluntary contributions are not permitted.

Workmen's Compensation
Mining companies contribute to the Wyoming Workmen's Compensation Fund at a rate that is determined for the area in which the mine is located. The rate for 1992 is 1.47 percent, which is applied to the total gross salary.

Reclamation and Bonding

Reclamation Bonds

Wyoming reclamation bonding levels are set by law at a minimum bond of $10,000. The bond must cover the entire cost of reclamation and the cost to restore any ground water disturbed by in situ mining, based on the coal operator's estimates.

The bond is held for a period of at least 5 years past the final reclamation activities. The area must be inspected and approved before the entire bond may be released. Partial release of the bond is possible with approval of the landowner and the administrator of the Land Quality Division of the Department of Environmental Quality.

Surety bonds, collateral bonds, or self-bonding are acceptable, provided Wyoming State regulations on bonding are followed. In some instances, the landowner may also be required to sign the surety bond. Collateral bonds must be either cash, a first lien on real property in the State of Wyoming, investment-grade securities, certificates of deposit, or letters of credit and must be in accordance with established regulations. Self-bonding may be accepted without separate surety if the applicant demonstrates to the satisfaction of the administrator 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.

APPENDIX C

DESCRIPTION OF INDONESIAN AND U.S. COAL MINES

This appendix contains a brief history of coal mining in Indonesia and characterizes the Indonesian and U.S. mines analyzed in this study. Additional information covers the history of coal mining in Indonesia and typical mining operations.

The Indonesian coal mines in this study are on the islands of Sumatra and Kalimantan. Although only seven Indonesian coal mines were included in this study, brief descriptions of all of the major Indonesian coal mines and projects are included in this appendix.

Following the sections on coal mining in Indonesia, the U.S. mines in this study are briefly described. These mines are in the States of Alabama, Kentucky, New Mexico, Washington, and Wyoming.

Indonesian Coal Mines

History of Coal Mining in Indonesia

Indonesia's first coal mine was developed by the colonial Dutch at Pengaron, South Kalimantan in 1849. Coal seams were discovered in West Sumatra in 1868. In 1892, the first coal mine at Ombilin was developed, and steamships began to bunker this coal at the Teluk Bayur harbor near Padang. Anthracitic coals were first mined near Bukit Asam in 1919. In addition to these two Sumatran operations, there were six small underground mines operating on the east coast of Kalimantan in the early 1900's. Pre-World War II annual coal production peaked at 2.0 Mmt in 1941.

Conscription of the coal mines during World War II led to decreased production. Since shortly after Indonesia's declaration of independence in 1945, Indonesia's coal ownership and development has been controlled by the Government. Beginning in 1950, coal mining was regulated by the Indonesian Directorate of Mines. In 1958, the mining agency was reorganized as the General Bureau of State Mining, and in 1961 it was reorganized as the Management Board of State Coal Mines. Coal production deteriorated during the 1960's because of market contraction and the lack of funding for equipment maintenance and replacement. In 1968, another reorganization resulted in the creation on Perusahaan Negara Tambang Batubara (P.N.T. Batubara) to oversee coal mining in Indonesia. Coal production continued to decline until production reached less than 150,000 mt in 1973.

Just prior to the first OPEC oil embargo, there was serious consideration of closing the remaining Indonesian coal mines. In

1973, the Saudi oil embargo revitalized Indonesia's interest in its coal resources. In 1974, the South Sumatra Coal Exploration contract was signed by P.N.T. Batubara and Shell Mijnbow B.V. (a subsidiary of the Royal-Dutch Shell group). After spending more than U.S.$50 million on exploration to delineate approximately 18 billion mt of lignitic coal, Shell MBV withdrew from the project in the early 1980's because of the low heating value of the coals. Based on the Shell exploration work, the decision to construct the integrated Bukit Asam coal mining/transportation project to fuel the Suralaya coal-fired generating project was made in early 1981. In 1981, P.N.T. Batubara was re-organized and named Perum Tambang Batubara (P.T. Batubara). In January 1991, P.T. Batubara was merged into P.T. Tambang Batubara Bukit Asam (PTTBBA) to facilitate project financing for an expansion of the Ombilin works. PTTBBA now operates the Ombilin and Bukit Asam projects, administers the cooperative coal contracts, and manages the further development of Indonesia's coal resources.

In order to conserve valuable petroleum for export, a Presidential Decree was issued in 1976 to convert Indonesia's electric utilities and cement kilns to coal fueling. In recognition of limited funds and technology, the Indonesian Government began to consider foreign investors as a means to accelerate the development of Indonesia's coal resources. In June 1978, P.N.T. Batubara, acting under Mining Law Number 11 of 1967 and the Foreign Capital Investment Law Number 1 of 1967, invited tenders for coal development on eight blocks in East and South Kalimantan to boost domestic coal production. In early 1981, Presidential Decree number 49 of 1981 authorized P.T. Batubara to contract with foreign and private contractors to explore and develop other potential coal resources. The first concessions were awarded to P.T. Arutmin and P.T. Utah on November 2, 1981. Ten coal concessions have been awarded since 1981, and several of the contractors have begun commercial production. In the interim period, the State-owned Ombilin mine has been expanded, and the Bukit Asam project has been completed. In addition to the mining concessions and Government mines, there are about 20 small private coal mines in Indonesia (mostly in the Benkulu region on Sumatra and the Mahakam River on Kalimantan). In 1992, the Government mines produced 7.2 mt, the coal contractors produced 13.8 mt, and the private mines produced 1.8 mt.

The majority of the Indonesian coal mines are surface operations that have relatively low stripping ratios. Most of these mines are close to tidewater. Virtually all of these mines require extensive infrastructure development because of remote locations. The majority of the export coal developments are on Kalimantan with minor tonnages exported from the Sumatran mines. On Sumatra, the Ombilin mining complex and Bukit Asam primarily serve domestic markets.

Mine Descriptions

The Ombilin mine complex near Sawahlunto, West Sumatra, is owned and operated by the Indonesian Government. This mine complex consists of the Tanah Hitam open pit and the Sawah Rasau underground longwall operation, a coal-fired powerplant, a central preparation plant, narrow gage rail, and the Teluk Bayar Port facilities. This deposit is in an intermountain coal basin that was deposited during the Eocene Period. Post-depositional tectonic deformations resulted in a narrow synclinal coal basin. The coal-bearing strata dips from 12 to 25 degrees near the mining complex on the western flank of the basin. Extensive localized faulting has been reported. Three coal seams have been mined in the Sawahlunto formation: A-seam (2.0 m thick), B-seam (0.8 m thick) and the C-seam (6.0 m thick) from top to bottom. The Ombilin coals are high-volatile B bituminous, low ash, low sulfur and have high heating values.

The Ombilin works produced approximately 0.9 Mmt in 1992 with most of this tonnage coming from the surface operations. Approximately 0.5 Mmt was exported in 1992.[21] The Sawahluwung underground mine is scheduled to begin production in 1993. Ongoing exploration and development at Ombilin is being funded by Japan's New Energy and Industrial Technology Development Organization, a branch of the Ministry of Industry and Trade (MITI), in anticipation of further production expansions of up to 2.5 Mmt/yr.

The Bukit Asam mine complex is also owned and operated by the Indonesian Government. The Bukit Asam project is near Tanjung Enim in south Sumatra. Although coal mining began at Bukit Asam in 1919, the current mining project was initiated in 1981 to supply the Suralaya power station in west Java. This complex includes a large open pit at Air Laya that uses bucket wheel excavators and conveyor haulage. Two contractor-operated, truck/shovel surface mines at Muara Tiga supplement Bukit Asam's output. A 430-km rail line, the Tarahan Port, and self-unloading vessels are used to transport the coal to the Suralaya power station on Java.

The Air Laya pit contains five coal seams of 2-10 m in thickness. The Air Laya mine has an average stripping ratio of approximately 3.1 BCM/mt to a maximum depth of 150 m. Problems at Air Laya have included spoil slope stability, hardness of the coal, wet conditions, equipment maintenance, and repair parts availabilities. After several years of problems with the continuous mining systems, delays in construction of the rail system, and subsidence at the port, Bukit Asam produced approximately 6.3 Mmt in 1992. The Air Laya pit produced 3.0 Mmt, and the Muara Tiga pit produced 3.3 Mmt in 1992. In 1992, approximately 4.3 Mmt was shipped to the Suralaya power station,

[21] Australian Coal Report. March 1993, p. 12.

1.5 Mmt was shipped to other domestic customers, and 0.5 Mmt was exported to Japanese and Taiwanese utilities.[22]

P.T. Adaro Indonesia is a coal contractor to PTTBBA. Adaro is a joint venture company that is 50 percent owned by Indonesia Coal Pty., Ltd. (a subsidiary of New Hope Mining, Ltd., Australian), 20 percent owned by Enadimsa (Spanish), 15 percent owned by P.T. Tirtamas Majutama (Indonesian), and 15 percent owned by P.T. Asminco Bara Utama (Indonesian).

The Adaro coal deposit is near the town of Tanjung in South Kalimantan. Since this region is a major oil-producing area and is on the Trans-Kalimantan highway, it benefits from a well-developed local infrastructure. Extremely thick (more than 70 m), subbituminous coal seams have been discovered on the Adaro concession. The Adaro coal has an extremely low sulfur content (less than 0.1 percent) and a low ash content (less than 2 percent, in situ). Although this coal has a moderate calorific value, it has a good grindability index and good storage and transportation stability (low spontaneous combustion tendency).

The Adaro reserves consist of several thick coal seams that range from 10-70 m. This coal deposit has undergone extensive tectonic deformation with local dips of up to 70 degrees. However, much of this deposit dips at 5 to 15 degrees and subcrops under relatively flat topography. The coal rank increases from the northwest (Wara area at 35 percent moisture, as-received basis) to the southeast (Paringin area at 25 percent moisture). Adaro has proven reserves of approximately 300 Mmt, indicated reserves of more than 300 Mmt, and inferred reserves of more than 800 Mmt at an average stripping ratio of less than 4.0 BCM/mt.

Initial mining utilized contracted dozers and scrapers for overburden removal and hydraulic backhoes and 40-mt trucks for coal mining. These trucks traverse a 73-km gravel road to the Kelanis barge loading dock on the Barito river. Adaro is planning to upgrade the haul road with a bituminous surface and go to 150-mt "road-trains". Initially, coal will be barged in 5-10,000 dwt barges approximately 170 km to a transloading area at the mouth of the Barito river. Adaro has contracted a 120-mt floating crane to load panamax sized vessels. In late-1993, it is planned to barge the coal to the Indonesian Bulk Terminal on Pulau Laut (approximately 450 km) for transshipment to capesize vessels. Adaro will also use the larger barges for direct shipments to local markets (Indonesia, Malaysia, the Philippines, etc.).

Adaro shipped its first test tonnage in November, 1991 and produced 0.9 Mmt in 1992. Current plans call for 4 Mmt per year in 1994. At present, Adaro is studying the use of continuous surface miners, in-pit crushing and conveying systems and other

[22]Work cited in footnote 21.

high-volume/low-cost mining and transportation options including a captive rail system. Adaro recently announced that it was looking at production levels of more than 20 Mmt/yr by the year 2000.

P.T. Allied Indo is a coal contractor to PTTBBA. P.T. Allied Indo is 100 percent owned by P.T. Mitra Abadi Sakti (Indonesian). Abadi Sakti purchased the majority share (80 percent) from Allied Queensland Coalfields Pty., Ltd. (Australian) for U.S.$5.7 million in August 1992. P.T. Allied Indo operates an open pit mine at Parambahan, about 6 km east of the Ombilin complex. Small trucks and hydraulic shovels are used to mine the overburden and coal. The coal is trucked to the Ombilin rail facility where it is transported via the rail system to Teluk Bayur. Although initial production was selectively mined and shipped raw, Allied Indo has installed a small modular washing plant for partial washing. Using the Ombilin infrastructure, P.T. Allied Indo was the first coal contractor to ship export coal (1987). This coal concession contains 12.5 Mmt of recoverable reserves, and the planned production level is approximately 600,000 mt per year for 20 years. Mining conditions are very similar to the Tanah Hitam operation at Ombilin. United Tractor (Indonesian Komatsu dealer) is subcontracted to provide all coal and overburden mining. Because of the use of the Ombilin infrastructure, P.T. Allied Indo pays a 20 percent royalty (in-kind or on gross revenues at PTTBBA's choice).

P.T. Arutmin is a coal contractor to PTTBBA. Arutmin is a joint venture company that is 80 percent owned by Utah Exploration, Inc. (a subsidiary of Broken Hill, Pty., Australian) and 20 percent owned by the Bakri brothers (Indonesian). The Arutmin block contains several different coal deposits. The higher rank (bituminous) coal deposits include West Senakin, East Senakin, Satui, Ata and Pulau Laut. Arutmin reports more than 800 Mmt of recoverable bituminous coal reserves at these deposits. More than 1.5 billion mt of lower rank coal (lignite) has been identified at Saronga and Asam-Asam. These Miocene lignites are characterized by thick seams (15-50 m), unconsolidated overburden, low stripping ratios, and are relatively flat lying. Since these deposits are within 5-10 km of tidewater, they could be produced at a very low cost for the local market. Self-heating and spontaneous combustion tests indicate that these lignites have low reactivity.

Both the East and West Senakin deposits are characterized by thick coal seams, frequent minor displacement faulting, high-ash partings, and higher-ash areas. Selective mining and blending is used to control ash levels at the West Senakin pits. Modular preparation plants are being constructed for both the West and East Senakin operations. The Satui deposit is faulted but has lower ash levels. Low grindability has restricted the utilization of the Senakin coals in certain markets.

The West Senakin mine shipped approximately 1.0 Mmt, and the Satui mine began production in 1990. In 1991, the Satui mine production capacity was increased to approximately 2.0 Mmt/yr. In late 1992, Arutmin began expansion of the West Senakin mine by constructing a 1.0-Mmt/yr wash plant. Total West Senakin capacity will be increased to 2.0 Mmt/yr, and higher quality products will be produced. Arutmin also announced the development of a 2.0 Mmt/yr mine and preparation plant near Manggis on the eastern side of the Senakin peninsula that is scheduled be operational in 1993. To support these mines, a barge-to-ship transloading port has been constructed on the northern side of Pulau Laut for panamax vessels. This berth could be dredged to accommodate capesize vessels. Arutmin has announced potential expansions to approximately 10 Mmt/yr depending on market growth. In 1991, Arutmin shipped 2.4 Mmt and shipped 3.1 Mmt in 1992.

P.T. Berau is a coal contractor to PTTBBA. Berau is now owned 60 percent by United Tractor (Indonesian Komatsu dealer) who purchased this interest from Mobil Oil Corporation (U.S.) for $9.8 million in December, 1990. Nissho Iwai (Japanese) owns 40 percent of the joint venture. Initial production is expected from the Lati area in 1993.

Berau will use dozers, hydraulic shovels and trucks for overburden removal. Coal will be mined with hydraulic backhoes and loaded into trucks. An 8-km haul road will connect the Lati mine with a barge loading dock on the Berau river. The coal will be barged approximately 70 km to a protected transloading area. Initially, geared vessels of up to panamax size will be used to transload this coal. If sufficient markets develop, Berau has considered floating cranes that could load capesize vessels. This coal will also be shipped in seagoing barges to local customers.

Berau is scheduled to mine approximately 400,000 mt in 1993 and increase production to 2.0 Mmt per year in 1994-1995. Because of the lower heating value and a somewhat unusual ash chemistry (high sodium), this coal may be restricted to the local markets. If demand warrants, production could easily be increased to more than 5.0 Mmt/yr.

P.T. Chung Hua Overseas Mining Development is a coal contractor to PTTBBA. Chung Hua is a joint venture that is 50 percent owned by EMRO (Taiwanese) and 50 percent by Tai Power (Taiwanese). Chung Hua's deposit is about 70 km east of Banjarmasin in South Kalimantan. Chung Hua is still in the exploration and engineering phase of development. No coal production is expected until the mid-1990's.

P.T. Kaltim Prima Coal is a coal contractor to PTTBBA. Kaltim Prima is 50 percent owned by CRA, Ltd. (Australian) and 50

percent owned by British Petroleum (U.K.). CRA is the operating partner.

The Kaltim Prima mine is approximately 15 km northwest of Sangatta in East Kalimantan. The coal mine is on the flanks of the Pinang dome, an intrusive structure. Various reports attribute this dome to volcanic intrusives at depth or a diapiric structure such as a salt dome at depth. Six major coal seams and several minor seams that range in thickness from 1 to 9 m will be mined. The overburden consists of mudstones, siltstones, and shales. Seam dip is approximately 5 percent over much of the deposit with local steepening near faults and deformation structures. The average stripping ratio is approximately 6 BCM/mt with a 12:1 cutoff ratio.

Kaltim Prima uses hydraulic shovels and trucks to mine the overburden and coal. Approximately 20 percent of the coal will be selectively mined and washed to remove inherent and dilution-related ash. The 1.5 Mmt/yr preparation plant uses dense medium cyclones for coarse beneficiation and spirals for fines cleaning. The washed/blended products are transported from the plant to the port via an overland conveyor system. The Tanjung Bara Port can accommodate capesize vessels. In 1992, Kaltim Prima shipped approximately 6.8 Mmt. Kaltim Prima recently announced further expansions to more than 10 Mmt/yr.

P.T. Kendilo Coal is a coal contractor to PTTBBA. The name of this concession was changed from P.T. Utah in 1993. Kendilo is 80 percent owned by Utah Exploration, Inc., a subsidiary of Broken Hill, Pty. (Australian), and 20 percent is owned by Mitsui Mining (Japanese). Broken Hill also owns the Arutmin block in South Kalimantan. Kendilo has delineated three separate bituminous coal deposits: Petangis, Bindu and Betiti. These coal deposits are near Tanah Grogot, about 100 km southwest of Balikpapan in East Kalimantan.

These coal deposits are highly faulted and dip approximately 10 to 15 degrees. Approximately 67 Mmt of in situ coal has been mapped to a depth of 100 m. The average stripping ratio is approximately 5 BCM/mt (raw). The high inherent ash of this coal will require washing to produce a marketable product. This coal has a low (30-40) hardgrove grindability index. The Bindu coal has a high sulfur level (2.5-3.0 percent).

Initial production of approximately 1.0 Mmt/yr is planned from the Petangis deposit in the southern part of the concession in 1994. The Kendilo coal seam in this deposit averages 4-5 m in thickness. Current mining plans include drilling and blasting the overburden using ANFO blasting agents. Overburden removal will be accomplished with small hydraulic excavators and trucks. The coal will be washed at a small modular preparation plant and then hauled approximately 15 km to a barge loading port on the South Apar river. These barges will be transloaded to geared vessels in Apar Bay, shipped directly to local customers, or

towed to the transloading facility that Arutmin is building on Pulau Laut.

P.T. Kideco Jaya Agung is a coal contractor to PTTBBA. Kideco is a joint venture of four Korean companies: Hanil Cement Mfg. Co., Ltd. (25 percent); Pan Ocean Bulk Carriers, Ltd. (25 percent); Samchok Consolidated Coal Mining, Ltd. (25 percent); and Youngsan Transportation Co., Ltd. (25 percent). The Kideco deposit is approximately 40 km west of Tanah Merah in East Kalimantan.

Kideco has delineated three coal fields in its concession, Samarangau, Roto East, and Roto West. Ten or more minable coal seams have been mapped in these areas. These coal seams have a moderate dip and have a low ash content.

Kideco is planning to remove the overburden with hydraulic excavators and ripping to avoid the high cost of explosives in Indonesia. The current mining equipment includes trucks, hydraulic shovels and auxiliary equipment. The coal will be hauled 40 km to a port site in Adang Bay in 50-mt trucks. Extensive dredging and a cellular concrete pier will permit a 1,500-mt/hr shiploader to service panamax vessels. Kideco's initial mine began shipments in 1992 and will have a 2.5-Mmt/yr capacity. Kideco has indicated that this facility could easily be expanded to 4.3 Mmt/yr if warranted by the coal markets. In 1992, Kideco shipped approximately 0.2 Mmt.

P.T. Multi Harapan Utama is a coal contractor to PTTBBA. Multi Harapan is a joint venture that is 50 percent owned by New Hope Indonesia Pty., Ltd. (Australia), 40 percent owned by Mr. Ibrahim Risyad (Indonesia), and 10 percent owned by P.T. Asminco Bara Utama (Indonesia). The Multi Harapan concession is on a part of the former Agip/Consol concession that was relinquished in 1985. Multi Harapan has delineated several coal deposits including Busang, Gitan, Loa Haur and Loa Kulu. Total reserves exceed 200 Mmt.

Ongoing exploration is being conducted to better define the identified reserves and to delineate additional reserves. The Busang mine began production in 1988, and a second mine at Gitan is scheduled to begin production in 1994. These deposits are approximately 60-80 km up the Mahakam River from Samarinda in East Kalimantan.

These coal deposits are in structural synclines and have dips that vary from almost flat to more than 10 degrees. These coal deposits have four major seams that are 1-6 m thick and several smaller seams and splits. Minor faulting has been reported in these deposits.

Contractors are currently being used to mine and transport the coal to a barge dock at Beloro. The overburden is removed with small hydraulic shovels, small trucks, and dozers without

blasting. The coal is mined with small backhoes and hauled approximately 22-km to the Beloro facilities. At Beloro, the run-of-mine coal is crushed and wet screened to remove fines, clay dilution, and parting materials. The washed coal is then loaded into barges for transport to geared vessels in the Mahakam delta or direct shipment to local customers.

The Busang mine has an annual capacity of 1.5 Mmt/yr, and the Gitan mine should produce approximately 1-2 Mmt/yr in 1993-94. Multi Harapan could use the planned P.T. Dermaga floating terminal or the Indonesian Bulk terminal to load larger and/or ungeared vessels. Multi Harapan shipped approximately 1.2 Mmt in 1992.

P.T. Tanito Harum is a coal contractor to PTTBBA. Tanito Harum is a PMDN (publicly traded on the Jakarta exchange) company that is owned by Indonesian investors. Tanito Harum began mining as a small private mining company in 1983. In 1987, Tanito Harum obtained as adjacent coal concession. This concession is part of the former Agip/Consol concession that was relinquished in 1985.

The Tanito Harum block is approximately 50 km up river from Samarinda in East Kalimantan. The mining conditions and geology at Tanito Harum are similar to the adjacent Multi Harapan block. Tanito Harum reports surface minable reserves of approximately 20 Mmt in the Sukodadi, Pondok, and Busang mining blocks (Mine I) and 30 Mmt in the Sebulu, Sigihan, and Ketapang mining blocks (Mine II). These reserves are to a maximum stripping ratio of 10.0 BCM/mt and average about 6.0 BCM/mt. Tanito Harum reports approximately 80 Mmt of reserves recoverable by underground methods on this block.

Contractors (Jaya Sumpiles) are used for overburden removal, coal mining, and coal haulage. Overburden is removed with small hydraulic shovels, wheel loaders, small trucks, and dozers without blasting. The coal is mined with small backhoes and hauled approximately 30 km to the Loa Tebu I plant and barge dock and approximately 21 km to the Loa Tebu II plant and barge dock. The Loa Tebu I plant has a capacity of approximately 0.5 Mmt/yr, and Loa Tebu II has a capacity of 1.0 Mmt/yr. At both of these facilities, the run-of-mine coal is crushed and wet-screened in trommels to remove fines, clay dilution, and parting materials. The washed coal is then loaded into barges for transport to geared vessels in the Mahakam delta or direct shipment to local customers. Tanito Harum shipped approximately 1.2 Mmt in 1992. Tanito Harum plans to increase its capacity to approximately 1.5 Mmt/yr in 1993.

U.S. Coal Mines

Only the U.S. mines that were used to determine the cost ranges for Cases I through IV are described in this section. These mines are in the States of Alabama, Kentucky, New Mexico, Washington, and Wyoming. State and local taxation and the regulatory requirements for these mines are discussed in Appendix B.

Alabama

One large underground mine in the State of Alabama was examined in Cases IV and V of this study. This mine produces both metallurgical and low-sulfur thermal products for domestic and export markets. This mine currently produces approximately 2.5 Mmt of clean coal per year. The average depth of this mine is 600 m, and the coal seam thickness is approximately 1.5 to 2.0 m. The immediate roof material is shale and sandy shale, and the floor is fireclay and shale. Because of the depth of this mine, high methane levels are problematic.

Longwalls and continuous miners are used for production and development at this operation. Resin bolts are used for primary roof support. This coal is washed using heavy media and flotation techniques. The washed product is trucked to a barge loading dock on the Black Warrior river. Export coal is barged approximately 650 km to McDuffie Island on the Gulf of Mexico.

Kentucky

One large surface coal mine and one large underground mine in the State of Kentucky were examined in this study. These mines produce low-sulfur thermal and coking coal products for domestic and export markets.

The Kentucky surface mine is included in the Case IV comparisons. This mine currently produces approximately 2.2 Mmt/yr of clean bituminous coal from private lands. Six coal seams that range from 0.6 to 2.2 m are mined. The average stripping ratio is approximately 16 BCM/mt.

Overburden is fragmented using rotary blasthole drills and explosives. Cable shovels and trucks are used in conjunction with draglines to remove the overburden. Wheel loaders and trucks are used for coal mining. The coal from several pits is washed at a central preparation plant using heavy-media methods. The clean product is either loaded onto unit trains or trucks for transport to domestic consumers or export at Newport News, Virginia.

All mined areas are reclaimed except for active pit areas and immediate backfill areas. Reclamation consists of topsoil removal prior to mining, backfilling to the approximate original

contour, topsoil replacement, seeding with native species, and the application of soil amendments. Surface runoff waters are directed through sediment ponds prior to discharge. Reclamation requirements include the establishment of sufficient vegetation to prevent erosion and to support indigenous wildlife. The mined land must be restored to the original condition before reclamation bonds are released.

The Kentucky underground mine is included in the Case IV and Case V comparisons. This mine produces both metallurgical and low-sulfur thermal products for domestic and export markets. This mine currently produces approximately 2.7 Mmt of clean coal per year. The average depth of this mine is 200 to 300 m and the coal seam thickness is approximately 2.5 to 3.0 m. The immediate roof material is shale and sandstone, and the floor is fireclay and shale.

Longwalls and continuous miners are used for production and development at this operation. Resin bolts and trusses are used for primary roof support. This coal is washed using heavy-media and flotation techniques. The clean product is loaded onto unit trains for transport to domestic consumers or export at Newport News, Virginia.

New Mexico

One surface coal mine in the State of New Mexico was examined in the Case II of this study. This mine produces a thermal coal product for local markets.

This mine currently produces approximately 2.0 Mmt/yr of subbituminous coal from Federal and private lands. Four coal seams that are 2 to 10 meters thick are mined. These coal seams dip approximately 10 to 15 degrees from horizontal. The average stripping ratio is approximately 3.0 BCM/mt.

Overburden is fragmented using rotary blasthole drills and explosives. Cable shovels and trucks are used to remove the overburden. The coal is ripped with large tractors when necessary. Wheel loaders and trucks are used for coal mining. The run-of-mine coal is transported by large truck trains (two 91-mt trailers and tractor) to a central crushing plant and stockpile before shipment to a nearby thermal generating station.

All mined areas are reclaimed except for active pit areas and immediate backfill areas. Reclamation consists of topsoil removal prior to mining, backfilling to the approximate original contour, topsoil replacement, seeding with native species, and the application of soil amendments. Surface runoff waters are directed through sediment ponds prior to discharge. Reclamation requirements include the establishment of sufficient vegetation to prevent erosion and to support indigenous wildlife. The mined

land must be restored to the original condition before reclamation bonds are released.

Washington

One surface coal mine in the State of Washington was examined in the Case V of this study. This mine produces a thermal coal product for domestic and export markets.

This mine currently produces approximately 0.3 Mmt/yr of bituminous coal from private lands. Seven coal seams that are 1 to 7 meters thick are mined. These coal seams dip approximately 15 to 45 degrees from horizontal. The average stripping ratio is approximately 3.2 BCM/mt (raw).

Overburden is fragmented using rotary blasthole drills and explosives. Hydraulic shovels and trucks are used to remove the overburden. The coal is ripped with large tractors when necessary. Wheel loaders and trucks are used for coal mining. The run-of-mine coal is transported by 50-mt trucks to an adjacent preparation plant. The coal is crushed to less than 3.8 mm, and the coarse fraction is washed in a heavy media cyclone. Minus 28 mesh coal reports to spirals for cleaning and is dewatered in a centrifugal separator. Clean coal is loaded onto highway trucks for transport to local customers and the Port of Seattle for export. Approximately 25 percent of current production is exported to Japan.

All mined areas are reclaimed except for active pit areas and immediate backfill areas. Reclamation consists of topsoil removal prior to mining, backfilling to the approximate original contour, topsoil replacement, seeding with native species, and the application of soil amendments. Surface runoff waters are directed through sediment ponds prior to discharge. Reclamation requirements include the establishment of sufficient vegetation to prevent erosion and to support indigenous wildlife. The mined land must be restored to the original condition before reclamation bonds are released.

Wyoming

Five surface coal mines in the State of Wyoming were examined in this study. These mines produce a thermal coal product for local and Midwestern markets.

The first Wyoming surface mine is included in the Case I and Case V comparisons. This mine currently produces approximately 15 Mmt/yr of subbituminous coal from Federal lands. A single 15- to 20-m coal seam is mined in two lifts at this mine. The average stripping ratio is 1.6 BCM/mt.

Overburden is fragmented using rotary blasthole drills and explosives. Cable shovels and trucks are used in conjunction

with draglines to remove the overburden. The coal is fragmented using rotary drills and ANFO emulsion explosives. Cable shovels and trucks are used for coal mining. The run-of-mine coal is crushed using large roll-crushers at a central plant. Coal is stored in enclosed structures before loading onto unit trains.

All mined areas are reclaimed except for active pit areas and immediate backfill areas. Reclamation consists of topsoil removal prior to mining, backfilling to the approximate original contour, topsoil replacement, seeding with native species, and the application of soil amendments. Surface runoff waters are directed through sediment ponds prior to discharge. Reclamation requirements include the establishment of sufficient vegetation to prevent erosion and to support indigenous wildlife. The mined land must be restored to the original condition before reclamation bonds are released.

The second Wyoming surface mine is included in the Case I and Case V comparisons. This mine currently produces approximately 11 Mmt of subbituminous coal per year from Federal lands. A planned plant expansion will increase capacity to more than 20 Mmt/yr. Two coal seams that have an average combined thickness of 35 m are mined at this operation. The individual coal seams vary from less than 1 to more than 30 m in thickness. These coal seams are separated by a thin parting. The average stripping ratio is approximately 2.0 BCM/mt.

Overburden is fragmented using rotary blasthole drills and explosives. Stripping shovels and trucks are used to remove the overburden. The coal is fragmented using rotary drills and ANFO explosives. Shovels and trucks are used for coal mining. The run-of-mine coal is crushed using large roll-crushers at a central plant. Coal is stored in enclosed structures before loading onto unit trains. Reclamation, permitting, and bonding requirements and practices are similar to the first Wyoming mine listed in this section.

The third Wyoming surface mine is included in the Case II comparison. This mine currently produces approximately 4 Mmt/yr of subbituminous coal from Federal and private lands. Nine to twelve coal seams that are 2 to 25 m thick are mined from three pits. These coal seams dip approximately 20 to 30 degrees from horizontal. The average stripping ratio is approximately 4.0 BCM/mt.

Overburden is fragmented using rotary blasthole drills and explosives. Cable shovels and trucks are used to remove the overburden. The thicker coal seams are fragmented using rotary blasthole drills and ANFO explosives. Coal seams of less than 3 m are ripped with large tractors when necessary. Track dozers are used to push the steeply dipping coal down to level benches for loading. Wheel loaders and trucks are used for coal mining. The run-of-mine coal is crushed before being shipped by trucks and trains to the consumers.

This mine has a special exemption to the approximate original contour reclamation requirement. Because the large open pit was developed prior to the 1977 Surface Coal Mining Act, most overburden will remain in out-of-pit waste piles and the open pit will not be refilled. All final pit and waste pile surfaces must be graded to stable, erosion-resistant configurations. Reclamation requirements include the establishment of sufficient vegetation to prevent erosion and to support indigenous wildlife. Surface runoff waters are directed through sediment ponds prior to discharge. The mined land must be restored to the approved post-mining land use condition before reclamation bonds are released.

The fourth Wyoming surface mine is included in the Case II comparison. This mine currently produces approximately 1 Mmt/yr of subbituminous coal from Federal and private lands. Up to 10 coal seams that are 2 to 15 m thick are mined from a single pit. These coal seams dip approximately 20 to 25 degrees from horizontal. The average stripping ratio is approximately 5 BCM/mt.

Overburden is fragmented using rotary blasthole drills and explosives. Stripping shovels and trucks are used to remove the overburden. The thicker coal seams are fragmented using rotary blasthole drills and ANFO explosives. Coal seams of less than 3 m are ripped with large tractors when necessary. Track dozers are used to push the steeply dipping coal down to level benches for loading. Wheel loaders and trucks are used for coal mining. The run-of-mine coal is crushed before being shipped by trains to the consumers. Reclamation, permitting, and bonding requirements and practices are similar to the first Wyoming mine listed in this section.

The fifth Wyoming surface mine is included in the Case I and Case V comparisons. This mine currently produces approximately 2 Mmt/yr of subbituminous coal from Federal lands. Three coal seams that have an average combined thickness of 4 to 5 m are mined at this operation. The individual coal seams vary from 1 to 2 m in thickness. These coal seams are separated by thin partings. The average stripping ratio is approximately 4.2 BCM/mt.

Overburden is fragmented using rotary blasthole drills and explosives. A hydraulic shovel and trucks are used to remove the overburden. The coal is fragmented using rotary drills and explosives. Wheel loaders and trucks are used for coal mining. The run-of-mine coal is crushed at a central plant. Coal is stored in enclosed structures before loading onto unit trains. Reclamation, permitting, and bonding requirements and practices are similar to the first Wyoming mine listed in this section.

APPENDIX D

EXAMPLE OF PRE-1984 CONTRACT OF WORK [23]

Provisions of Basic Agreement on Coal Mining Between
P.N. Tambang Batubara (Coal Mining State Enterprise)
and a Private Contractor

By Decree of the President of Indonesia (R.I. no. 49, October 18, 1981) the following provisions for Agreements on Coal Mining between P.N. Tambang Batubara (Coal Mining State Enterprise) and Private Contractors are pronounced. The authority to sign contracts for and on behalf of the Government is transferred to the Minister of Mines and Energy.

The provisions of the Contracts are basically as follows:

I. LEGAL

1. The contractor is obligated to establish a Corporate Body according to Indonesian Law and domiciled in Indonesia.

2. P.N. Tambang Batubara is responsible for the management of the undertaking implemented by this Agreement. The Contractor bears the risk and the financial burden.

3. The agreement is valid for thirty years beginning with the start of the operational period.

II. TECHNICAL

1. The contractor is entitled to one year to conduct a general survey followed by an exploration period of three years. (These periods may be extended by mutual agreement.)

2. The contractor is entitled to a one year feasibility study period. The construction period is three years after receiving Government approval of his working scheme. Production may continue for thirty years thereafter.

3. Periodically the Contractor is obligated to report to the Government his results. The area held by the contractor will gradually be reduced (relinquished) so

[23]For proprietary reasons, the contractor's identity has been omitted from this Contract of Work.

that the area which is to be exploited will be a maximum of 25% of the original area.

4. The contractor is obligated to conduct special studies regarding the effect of mining development on the environment in the agreed area. Such studies shall include physical effects as well as economic and socio-cultural impact. The contractor shall submit a program for coping with the environmental impact to the Government.

5. The contractor is obligated to consult the Regional Administration concerning the utilization and development of infrastructure to ensure that cooperation, integration and synchronization are interwoven in the implementation of regional development.

III. FINANCIAL

1. The contractor is obligated to deliver 13.5% of coal production to P.N. Tambang Batubara

2. The delivery of coal production to the P.N. Tambang Batubara constitutes a substitute for and thus exempts the contractor from exploration and exploitation payments.

3. The contractor covers his production expenditures and fulfills his tax obligations and other levies to the Government out of his share of coal production (86.5%).

4. The contractor is obligated to pay taxes and levies to the Government as follows:

   a. During the first 10 (ten) years after the start of production, the Contractor will pay a corporation tax in the amount of 35% (thirty-five percent) of taxable profit. Beginning the eleventh year after the start of production the corporation tax is 45% (forty-five percent) of the taxable profit.

   b. Regional Development Contribution (IPEDA);

   c. Regional Taxes and Levies which have been ratified by the Central Government;

   d. General Administration Levies for facilities or services granted by the Government;

   e. Sales tax on services;

f. Stamp duty on loan agreements;

g. Excise taxes on tobacco and alcoholic drinks.

5. The implementation of contribution, tax levies and the levies mentioned in paragraph 4 letters b, c and d can be unified in a lumpsum payment stipulated in the Cooperation Agreement.

6. The contractor is also obligated to levy and to deposit with the Government the following taxes:

a. Tax on interest, dividends and royalties (PBDR) in the amount of 10% (ten percent);

b. Income taxes on the wages of Contractor's officials;

c. Sales tax on services provided by the Contractor to other parties;

d. Income from the sale of shares possessed by foreign participants to Indonesian participants.

7. The contractor is obliged to pay to the Government through P.N.T. Tambang Batubara Bukit Asam an amount of dead rent to be specified in the contract.

8. The contractor is exempted from import and export levies, and other levies for equipment utilized in contract implementation.

IV. OTHER

1. The contractor is obligated to implement measures to prevent pollution of the environment and preserve the natural resources of the region concerned.

2. Opportunities for employment and transfer of technology to Indonesian manpower will be implemented in as broad a manner as possible so that 75 percent of skilled positions will be held by Indonesian workers after the third year and 100% after eight years. For technical labor workers, supervisors, executives and experts, 85 percent of the work force will be Indonesian after eight years.

3. The participation and promotion of the National interest are agreed as follows:

   a. Four years after the start of the production phase, the Contractor is obligated to offer his shares to the Government or to Indonesian Nationals, so that at the end of the tenth year from the beginning of the production phase at least 51% of his shares should have been offered.

   b. The obligation for the Contractor to offer his shares as mentioned above remains valid until all snares offered have actually been purchased by an Indonesian party.

   c. In implementing the obligations under this Agreement, the Contractor is to emphasize the utilization of domestic products, Indonesian manpower and services.

4. In marketing his coal production, the Contractor is obligated to give priority to the domestic market.