COAL DEVELOPMENT IN THE NORTHERN GREAT PLAINS: The Impact on Revenues of State and Local Governments. Thomas F. Stinson and Stanley W. Voelker, Economics, Statistics, and Cooperatives Service, U.S. Department of Agriculture. Agricultural Economic Report No. 394.

ABSTRACT

Development of Northern Great Plains coal resources will create new demands for State and local government services. Development will also produce increased government revenues. Special taxes on coal production have been enacted in Montana, North Dakota, and Wyoming in order to insure that State and local governments receive sufficient revenues to finance the new services required. This study reports detailed estimates of the State and local taxes that would be paid by three different sized coal mines and their employees in Montana, North Dakota, South Dakota, and Wyoming. The estimates were obtained by using the ENERGYTAX simulation model.

Keywords: Taxation, Model, Economic development, Economic impact, Public finance, Public revenues

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SUMMARY

Development of coal resources in the Northern Great Plains need not create major financial problems for State and local governments. But while total State-local revenues will be adequate, some levels of governments, such as cities, may face serious revenue shortfalls when they provide additional services. Others, particularly the States, will have a surplus. These estimates are based on coal mines typical of those which might locate in Montana, North Dakota, South Dakota, and Wyoming, and on 1976 tax laws in those States. The estimates were obtained by using the ENERGYTAX simulation model.

Cities face particularly serious financial problems, with potential expenditures for increased services outpacing new revenues by more than 2 to 1. School districts which receive large numbers of new students but do not have mine property within their boundaries will have similar problems. The special coal impact funds established in Montana, North Dakota, and Wyoming could reduce these financial difficulties, however.

State and local governments in Montana would receive the most revenue from coal development; those in South Dakota the least. In Montana, both the 9.2- and the 5-million-ton-per-year mines would generate more than $55,000 annually per new employee directly employed by the mine. The same mines located in North Dakota and Wyoming would produce more than $18,000 per new employee. In South Dakota, where there is no special coal tax, the mines would produce only about $4,700 per year.

While in all States the total revenue available appears sufficient to meet the increased demands for services attributable to the mines, there are other considerations. First, government services are provided by several types of governments, each with their own sources of revenue. A significant financial problem for one or more levels of government could be hidden by a surplus at other levels. When the analysis is done by type of government, State governments, and to a lesser extent county governments, appear to receive enough new revenues to meet their needs. The cities, and in some States the school districts, appear less well off.

State and local governments may also face a cash flow problem when mineral development occurs. During the mine's construction and development phase, and during the period when the mine is being closed down, local governments will be required to provide services for the mine's employees at a time when tax revenues from the mine are minimal. Taxing at a rate somewhat higher than necessary during the operating years of the mine in order to provide the funds necessary for services during the low-revenue years is one way the front end and closedown problems can be minimized.

Finally, mines may inflict other social costs on the residents of a State or region. Increased taxes on the mines and decreased taxes on individuals can partially compensate for these costs.

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Thomas F. Stinson
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INTRODUCTION

The Nation's energy program places increased emphasis on the development and use of coal. Increasing production by more than two-thirds, to over 1 billion tons per year by 1985, is now a national goal. And, a number of measures designed to encourage major energy users to substitute coal for oil and natural gas have been proposed to Congress.

Much of the increased coal production is expected to take place in the Northern Great Plains States of Montana, North Dakota, and Wyoming. Of the additional 546 million tons of annual production identified as possible or planned for the United States by 1985, 243 million tons are expected to come from that area.1/ The region's thick seams of low sulfur coal are extremely attractive to energy developers because of the relatively low cost of mining. Until the more exotic sources of power -- wind, solar, and geothermal -- become economically efficient, coal exports from these States will steadily increase.

Development of Northern Great Plains coal will have a major impact on the region. Many are concerned about possible adverse effects on the quality of life in the area. Environmental groups fear that reclamation will prove to be impossible or that the States will not enforce sufficiently high reclamation standards. Others worry about the impact of relatively large population increases in these sparsely populated areas. Special concern has been voiced about the effects population growth will have on the community's ability to finance and deliver essential local government services such as education and police and fire protection. Because revenues produced by development may not increase as rapidly as the demand for services, local residents could see both a decline in their quality of life and an increase in their property tax bill. All these concerns, combined with a general feeling that minerals belong to the State and that the people of the State should receive some compensation for their use, have led to pressure for higher State taxes on coal production.

Now, as the rest of the Nation faces higher utility bills, State coal taxes are under fire. A national research organization has characterized the existing State tax situation for western coal as being the same as "OPEC like revenue maximization."2/ The same report noted that, "If the states do not exercise

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1/ Office of Coal, Federal Energy Administration, Coal Mine Expansion Study, May 1976, p. 19.

2/ Richard Nehring and Benjamin Zycher with Joseph Wharton, Coal Development and Government Regulation in the Northern Great Plains: A Preliminary Report, R-1981-NSF/RC, Rand Corp., Santa Monica, Calif., Aug. 1976, p. 148.

restraint in applying their taxing powers, the federal government may wish to set limits on the level of special taxes on energy production."3/ Clearly, some believe that taxes on coal production are excessive.

This study, focusing on the taxation issue, reports the results obtained when a computer simulation model (ENERGYTAX) was applied to data describing three model mines typical of the size of development likely to occur. Estimates of the revenue accruing from each model mine and its employees for each major tax levied at each level of government are presented for Montana, North Dakota, South Dakota, and Wyoming. In addition, estimates of the intergovernmental revenues directly attributable to coal development are given. The report describing the tax simulation models and the model mines, discusses the simulation results and notes what can and cannot be concluded.

This study is only a first step in estimating the net fiscal impacts of new coal development on State and local governments in the Northern Great Plains. Only direct revenue impacts are reported. No attempt is made to estimate revenues derived from the secondary or ancillary development which may accompany the mine, nor is any attempt made to estimate the costs associated with providing the government services required by new workers. While average per capita expenditures are provided for comparison purposes, they are only general guidelines. They should not be used to estimate the additional public sector costs associated with a project. Studies are currently underway to develop improved methodologies for estimating secondary revenues and public sector costs. The results obtained using a more complete model will be the subject of a later report.

THE ENERGYTAX MODEL

ENERGYTAX, a simulation model developed by the Economic Research Service, was used to produce the revenue estimates presented in this report. ENERGYTAX is actually a family of four separate models, each of which is similar in its basic structure. Each model, however, includes parameters which reflect the tax system and intergovernmental aid structure of a particular State. At present, States for which revenue impacts of coal development can be simulated are Montana, North Dakota, South Dakota, and Wyoming.

The simulation models estimate taxes paid and revenue flows for any coal-related energy development. Export mines, thermogenerators, and gasification plants in any combination can be included with no modification of the model. All that is required is that the user provide the necessary information about the size of the development, its work force, and the estimated values of production and equipment. (A more complete description of the input data required by the model is given in Appendix A.) Given these input data, ENERGYTAX will generate reliable estimates of the State and local taxes paid by the mine or coal conversion plant and its employees. The accuracy of these estimates depends in large part on the accuracy of the data provided by the user.

ENERGYTAX is more closely related to accounting models than to large-scale economic forecasting models. The program is a series of accounting identities

3/ Ibid., p. 100.

through which tax payments by source and flows of intergovernmental aid can be computed. Values for different types of taxable property are read into the program and the appropriate tax rates are applied to compute taxes paid. As part of the model, changes in the characteristics of the local community (such as number of school-age children and the total number of residents) and changes in the tax base associated with the new development are calculated, and then inserted into the proper State aid formula to determine the amount of aid attributable to development.

ENERGYTAX differs from a pure accounting model because the price of the coal or energy output is maintained internally at a level sufficient to keep the rate of return on discounted cash flow at 15 percent. Through a system of simultaneous equations, the model accounts for the effect that some taxes have on the tax base available for other taxes and on the price of the coal. This modification is important because, in some States, the price of the coal is a component of several tax bases. If the price were established without regard to the existing level of taxation, the price would be too low and revenues would be underestimated.

Development of ENERGYTAX required detailed analysis of each of the four States' tax and aid systems. For each State, the portions of the tax code that would affect the revenue available to State and local governments were identified and reduced to algorithms for use in the simulation. In addition, assessment practices, actual assessment ratios for different types of property, motor fuel consumption, and consumption of alcohol and tobacco had to be determined and included in the model.4/

Taxes identified and estimated for a mine or an energy conversion plant included State and local property taxes on land, equipment, and gross proceeds; State mineral taxes; special energy conversion taxes; State and local sales and use taxes; State unemployment taxes; and State corporate income taxes. State income taxes, sales taxes, alcohol and tobacco excise taxes, motor fuel taxes, motor vehicle registration fees, as well as State and local property taxes paid by individuals employed by the mine were calculated. In addition, estimates were made of changes in school aid payments and other intergovernmental transfers which depend on either the size of the local government or the revenues collected through a particular tax.

For this study, tax revenues were estimated for a normal operating year. ENERGYTAX is sufficiently general, however, to allow estimates to be made for any year from the beginning of development to the final closing of the mine. In this simulation, the firm's equipment is assumed to have depreciated to 75 percent of its original cost. When the firm's income taxes are computed, it is assumed that the mine is owned by a corporation which conducts business entirely

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4/ For Montana, North Dakota, and Wyoming, these descriptions of the State tax system have been published separately. See Layton S. Thompson, The Taxation and Revenue Systems of State and Local Government in Montana as of 1976, Dept. Agr. Econ., Montana State Univ., Staff Paper 77-12, June 1977, 59 pp.; Layton S. Thompson, The Taxation and Revenue System of State and Local Governments in Wyoming, Dept. Agr. Econ., Montana State Univ., Staff Paper 77-13, July 1977, 58 pp.; and Stanley W. Voelker, The Taxation of State and Local Governments in North Dakota, N. Dakota State Univ., Agr. Econ. Rpt. 117, Dec. 1976, 63 pp.

within the borders of the State. If this assumption does not hold, corporate income tax payments will be smaller since the State corporate income tax will be based on the provisions of the Multi-State Tax Compact. It is also assumed that the mine or conversion plant is located outside the corporate limits of any city; consequently, no municipal property taxes are paid by the firm.

Estimates of State income and sales taxes paid by employees are based on the average taxes paid by individuals in each $1,000-income class. The revenue from excise taxes and registration fees is estimated using the average tax per adult resident. Local real property taxes are computed for three types of housing -- single-family detached, rental units, and mobile homes -- based on 1976 average assessed values in coal producing counties. The housing choice pattern is assumed to be the same as that found in an earlier study of impact area housing.5/ The pattern found by the study -- 69 percent owner occupied, 16 percent rental, and 15 percent mobile homes -- is believed to be the best available estimate of the final distribution of workers among different types of housing.

The model does not allocate workers and worker families among different cities, school districts, and counties. Instead, it is assumed that all new residents locate in the same school district, county, and municipality, or equivalently, that tax rates are identical in all jurisdictions of the same type. Also, it is assumed that all workers live within the corporate limits of the municipality. This assumption produces an estimate of the upper bound of the potential revenues available for the city. To the extent that individuals locate outside the city, the tax revenues and State aid will be reduced proportionately.

The change in State school aid, the most important of the intergovernmental revenues, is computed by applying the formula used by the State to a typical district in the coal region before development occurred and then reapplying the formula after the hypothesized development. The estimated number of new students in the elementary, junior high, and senior high age groups is again based on North Dakota experience.6/ This model assumes that the average worker's family has 0.58 grade school students, 0.20 junior high school students, and 0.39 high school students. Total family size was assumed to average 3.37, with 87 percent of the workers married.

MODEL MINES

Three hypothetical strip mines were used in the simulations: a 2-million-ton-per-year lignite mine, a 5-million-ton-per-year subbituminous mine, and a large-scale 9.2-million-ton-per-year subbituminous mine. The basic structure of each mine was taken from Bureau of Mines publications.7/ Cost data for all

5/ Arlen F. Leholm, Larry Leistritz, and James S. Wieland, Profile of North Dakota's Coal Mine and Electric Power Work Force, N. Dakota Agr. Exp. Sta., Agr. Econ. Rpt. 100, Aug. 1975, p. 5.

6/ Ibid., p. 26.

7/ A short description of each model mine, the updated wage and investment cost schedules, and a complete citation to the original mines is provided in Appendix B.

three mines, however, had to be updated to reflect equipment prices and wage rates in early 1976. Each mine is similar to those currently operating in the region.

Few changes were made in the basic structure assumed for each mine in the Bureau of Mines reports. Minor changes were made in the equipment and manning tables to achieve comparability among the three sizes of model mines, however. The manning tables for the two smallest mines, for example, did not provide breakdowns of the maintenance and supervisory employees into occupational and professional categories. Other reports and unpublished survey materials were used to construct appropriate subsections of the manning tables so that frequency distributions could be made of the wage and salary earnings of employees. In some cases, this resulted in slight changes in total annual wage and salary costs of the mine.

The only substantive change made in the mine models was for the smallest mine. There, the estimated investment in farm machinery used for spoil-bank reclamation was reduced from $100,000 to approximately $32,000 to more accurately reflect actual costs.

Capital investments and annual operating costs were adjusted to the price level of early 1976 by use of appropriate price indexes. Most indexes used were selected from those compiled by the U.S. Bureau of Labor Statistics and published monthly in Wholesale Prices and Price Indexes. Two of the Engineering News Record price index series were used to adjust the capital value of buildings, roads, and general construction work. Prices of large draglines and coal shovels, for which no published price index series seemed appropriate, were established arbitrarily after a review of published and unpublished price information.

Wages were adjusted upward to the level of early 1976, in accordance with provisions of the 1971 and 1974 Bituminous Wage Agreements with United Mine Workers, including the cost-of-living allowance provided by the 1974 contract.

White collar salaries were updated to maintain approximately the same percentage relationship to the union salary schedule. All operating costs including union welfare payments were updated to reflect any changes which may have occurred.

The model mines used in the simulation have several important differences in structure, some of which have noticeable impacts on the taxes they pay. The most important difference is that the 9.2-million-ton mine was developed originally as a model of a mine to fuel a coal conversion plant producing 250 million cubic feet of high BTU gas per day. The other mines were assumed to be export mines. As a result, the 9.2-million-ton model does not include any loading or preparation facilities, nor are any employees assigned to preparation or loading duties. If a preparation plant and loading facility were added to the 9.2-million-ton mine, the firm would have higher capital costs and operating expenses, as well as a considerable difference in the property tax base of the mine. As a result, total tax payments would increase.

RESULTS

Estimated State and local tax payments by the mines and their employees varied greatly depending on both the State and size of mine used in the simulation (table 1). Revenues would be greatest for a 9.2-million-ton mine in Montana (more than $12.7 million per year) and smallest for a 2-million-ton lignite mine in South Dakota ($335,000). Within each State, larger mines produced more revenue. However, differences among the States were large for each size of mine. The simulations indicate that all three mines would pay substantially greater taxes in Montana than in the other States. The total tax bill would be smallest in South Dakota, while North Dakota and Wyoming would collect similar amounts considerably greater than South Dakota but less than half that collected in Montana.8/

Total revenue is not the best measure of the mine's impact, however. More revealing are estimates of tax collections from the mine and its employees divided by the number of new residents brought in by the development. This report focuses on those new residents directly attributable to the mine's development. That group, comprised of the mine's employees and their immediate families, creates the need for additional services. A vital question is: are the taxes paid by the mine and its employees sufficient to cover additional community costs associated with the development?

Development will also be accompanied by a second group of new residents: those employed in service or nonbasic industries and their families. These simulations do not attempt to estimate potential government revenues from those individuals or their employers. While future versions of the ENERGYTAX model will allow for estimation of revenues from ancillary development, this report deals only with direct impacts.

Estimated revenue per new resident is considerably greater in Montana than for the other States (table 2). Both the 5- and 9.2-million-ton mines would generate more than $16,000 in State and local revenue per new resident or more than $55.000 per new family. No mine in the other States would bring in even half this much revenue per new resident. The model mines in North Dakota and Wyoming would produce more than $5,400 per new resident or more than $18,000 per new family, however. The South Dakota mines, of course, would yield considerably less revenue, approximately $1,400 per new resident or $4,700 per new family.

Estimated taxes per ton of coal production vary from $1.72 for the 5-million-ton mine in Montana to $.10 for the 9.2-million-ton mine in South Dakota (table 3). In all States but Montana, the 2-million-ton lignite mine would pay the largest tax per ton of production. In Montana (due to the special 20-percent severance tax on lignite, as opposed to a 30-percent tax on subbituminous coal), the 5-million-ton mine would pay the most tax. In all four States, the largest mine would pay the lowest tax per ton. With the exception of Montana,

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8/ South Dakota has been included in the simulation even though no major coal development is expected. It can be thought of as a control State, indicating what the situation might be if no special coal taxes are enacted. South Dakota also has several taxes which are not used elsewhere in the region: a net proceeds tax and a property tax on the estimated mineral value of the land. Results from these taxes are useful for comparison purposes.

Table 1--Estimated annual State and local tax payments by mines and their employees, 1976

State and source of taxes	Size of mine (million tons per year)		
	2	5	9.2
	Dollars		
Montana:			
Paid by mine	2,721,512	8,586,069	12,442,809
Paid by employees	91,907	223,708	273,788
Total	2,813,419	8,809,777	12,716,597
North Dakota:			
Paid by mine	1,210,984	2,961,384	5,273,588
Paid by employees	105,274	212,513	258,676
Total	1,316,258	3,173,897	5,532,264
South Dakota:			
Paid by mine	272,172	601,691	922,095
Paid by employees	63,632	138,429	180,658
Total	335,804	740,120	1,102,753
Wyoming:			
Paid by mine	1,303,282	2,985,781	4,267,982
Paid by employees	43,546	96,536	125,910
Total	1,346,828	3,082,317	4,393,892

Table 2--Estimated annual State and local tax revenues per new resident attributable to mine operation, 1976

State and source of taxes	Size of mine (million tons per year)		
	2	5	9.2
	Dollars per new resident 1/		
Montana:			
All taxes	11,772	16,436	17,711
Taxes paid by families of mine employees	385	417	381
North Dakota:			
All taxes	5,507	5,921	7,705
Taxes paid by families of mine employees	440	396	360
South Dakota:			
All taxes	1,405	1,380	1,536
Taxes paid by families of mine employees	266	258	252
Wyoming:			
All taxes	5,635	5,750	6,120
Taxes paid by families of mine employees	182	180	175

1/ New residents are the mine employees and their immediate families.

Table 3--Estimated annual State and local tax payments by mines, per ton of production, 1976

State	Size of mine (million tons per year)		
	2	5	9.2
	Dollars		
Montana	1.36	1.72	1.35
North Dakota	0.61	0.59	0.57
South Dakota	0.14	0.12	0.10
Wyoming	0.65	0.60	0.46

where a $0.37-difference existed between the highest and lowest tax costs per ton, there was only a slight difference in the estimated taxes per ton on the three sizes of mines.

Aggregate estimates of State and local tax revenues tell only part of the story. Government services are provided by four major types of government: States, cities, counties, and school districts. Since each receives revenue from different sources, a significant financial problem for one or more governments could be hidden by a surplus at the other levels. The rest of this section discusses the revenues, including intergovernmental transfers, available to each type of government. Complete estimates of revenue by source for each level of government in each of the study States are given in Appendix C.

State Revenues

State governments would be major recipients of new tax revenues. Even when intergovernmental transfers are taken into account, States still retain more than half of all taxes paid by each mine and its employees. The State general fund, the fund into which those tax revenues not earmarked for specific purposes are deposited, would receive the single largest amount of new tax revenues in each State studied. Montana's general fund would receive the most and South Dakota's the least (table 4).

In each State, the special severance tax on minerals would produce the largest amount of new revenue (table 5). While both tax rates and the tax base vary greatly, all State mineral taxes produce considerable revenue. In fact, the 5-million-ton and 9.2-million-ton mines in Montana would each pay more than $7 million in severance taxes, more than the total of all taxes on the mine and its employees in any other State.

On a per ton basis, the Montana Severance Tax and the Resources Indemnity Trust Tax would range between $1.07 and $1.48 for the three mines, considerably more than North Dakota's $.52 per ton and Wyoming's $.22 to $.30 per ton. South Dakota's mineral tax, a net production tax, might be thought of as a net income tax. This tax would be much less, ranging from $.03 to $.06 per ton.

The second largest source of State tax revenue in Montana and North Dakota would be the corporate income tax or corporate license fee. In these States,

Table 4--Estimated annual State tax revenues per new resident attributable to mine operation and amount accruing to States' general funds, 1976

State	Size of mine (million tons per year)		
	2	5	9.2
	Dollars per new resident 1/		
Montana:			
All State taxes	10,083	14,740	15,901
Net to general fund 2/	5,172	6,953	7,482
North Dakota:			
All State taxes	5,306	5,769	7,531
Net to general fund 2/	1,975	2,091	2,581
South Dakota:			
All State taxes	963	893	935
Net to general fund 2/	975	877	891
Wyoming:			
All State taxes	2,997	3,129	3,359
Net to general fund 2/	2,211	2,311	2,480

1/ New residents are resident employees of the new mine and their immediate families.
2/ Amount of State taxes to be paid, less earmarked revenues and amount of State aid to local governments.

Table 5--Estimated annual State mineral tax payments, 1976

Item and State	Size of mine (million tons per year)		
	2	5	9.2
		Dollars	
State mineral taxes paid by the mine:			
Montana 1/	2,144,428	7,391,815	10,728,764
North Dakota 2/	1,040,000	2,600,000	4,784,000
South Dakota 3/	122,882	205,410	293,309
Wyoming 4/	597,407	1,384,859	2,004,570
		Percent	
Mineral taxes as a percent of all State taxes to be paid by the mine and its employees:			
Montana	89	94	94
North Dakota	87	84	88
South Dakota	53	43	44
Wyoming	83	83	83

1/ Coal severance tax and resource indemnity trust tax.
2/ Coal severance tax.
3/ Net production tax on all mines.
4/ Mineral excise tax and coal severance tax.

from $70,000 to $412,000 would be collected depending on the size of the mine. These estimates, however, are valid only for mines owned by companies conducting all their business within the State. For multi-State firms, the situation is quite different. The net income for these firms is divided among States in accordance with a three-factor formula specified in the Multi-State Tax Compact on the allocation of income for taxation.9/ For the Northern Great Plains States, acceptance of the Multi-State Tax Compact effectively eliminates any taxation of the net income derived from sales of coal for export. Consequently, while both the Montana and North Dakota results include an estimate of corporate income taxes paid, this figure should be regarded as an upper bound. Export mines selling out of State are more likely to pay only the State's minimum tax.

Sales and use taxes are also a major source of revenue for State governments in North Dakota, South Dakota, and Wyoming. Wyoming also has an optional county sales and use tax. Montana, however, does not levy a sales tax. While estimated State revenues are similar, differences in the items covered by the tax produce some variation among the States. For any given mine, South Dakota, which obtains the most revenue from the sales tax, would receive about one-third more revenue than would Wyoming. State sales tax revenues, while significant, are small compared to mineral tax revenues. Only in South Dakota would they be comparable in size.

Most sales tax revenues come from taxes paid by the mine on purchases of operating supplies and replacement equipment (table 6). These estimates pertain to a year when no major replacement equipment is purchased. Consequently, they should be considered estimates of the lower bound of potential revenues. In years when significant purchases of replacement equipment are made, sales tax revenues will be much greater. Sales and use taxes would also be collected on the initial complement of equipment installed at the mine. For the 9.2-million-ton mine, most of the original equipment cost of more than $30 million would be subject to State sales and use taxes. As a result, more than $1.2 million would accrue to the State's treasury during the mine's construction and development stage.

Estimated State taxes paid by workers are relatively small (table 7). North Dakota and Montana would raise similar amounts--approximately 50 percent more than South Dakota and more than twice as much as Wyoming.

North Dakota, the State with the largest average tax per employee, has both a sales tax and an individual income tax. Montana, which collects almost as much revenue from individuals, has only an income tax. South Dakota and Wyoming have a sales tax but no income tax. Estimates of the other taxes paid by individuals directly to the State are shown in more detail in Appendix C.

For all but South Dakota, the taxes paid by the new employees would be a small percentage of total State revenues accruing from the development--5 percent or less. In South Dakota, taxes on individuals would produce approximately 16 percent of the total State revenues from the new development. However, total State revenues would be much less in South Dakota than in the other three States.

9/ A more complete discussion of the Multi-State Tax Compact on the allocation of income may be found in Commerce Clearing House, State Tax Guide, Chicago, pp. 179-187.

Table 6--Estimated annual sales and use tax payments by mines and employees, 1976

State and tax source	Size of mine (million tons per year)		
	2	5	9.2
	Dollars		
North Dakota:			
Paid by mine	54,390	157,932	195,346
Paid by employees	12,014	25,947	30,848
Total	66,404	183,879	226,194
South Dakota:			
Paid by mine	60,485	172,014	248,221
Paid by employees	20,780	43,688	52,099
Total	81,265	215,702	300,320
Wyoming:			
Paid by mine	45,364	129,010	186,166
Paid by employees	12,769	27,613	33,579
Total	58,133	156,623	219,745

Table 7--Estimated annual State tax payments by mine employees and payments per new resident, 1976

Item and State	Size of mine (million tons per year)		
	2	5	9.2
	Dollars		
State taxes paid by mine employees			
Montana	60,719	128,736	146,191
North Dakota	68,301	143,239	157,462
South Dakota	38,727	83,356	105,943
Wyoming	25,703	56,576	72,378
State tax payments per new resident 1/			
Montana	254	240	204
North Dakota	286	267	219
South Dakota	162	155	147
Wyoming	108	105	101

1/ New residents are resident employees of the mine and their immediate families.

Local Government Revenues

Local governments--school districts, counties, and cities--will be required to provide most of the additional public services required by a mine and its workers. Revenue necessary to finance this expansion of services must come almost entirely from either the local property tax or State aid to local governments.

There are large differences in the property tax and State aid systems among the four States in this study. And, while it is not our intent to review all those differences, certain special features that affect the taxes paid by mines should be noted. The most important is the definition of the local property base.

North Dakota exempts from property taxes practically all personal property including mining machinery and equipment and the mine's gross proceeds. Only the value of the land and structures associated with the mine are included in the property tax base. Moreover, mineral values are not taken into account in determining the taxable value of the land. As a result, land used for mining is assessed at approximately the same amount per acre as is farmland in the area.

South Dakota includes mineral values in the assessed value of the land; personal property, including mining equipment and machinery, is also subject to tax. However, as in North Dakota, the gross proceeds of the mine are not subject to local property taxes.

Both Montana and Wyoming treat the gross proceeds of the mine as part of the local property tax base. The value of the machinery and other personal property of the mine is also included. While differences exist in the treatment of property and in the definition of gross proceeds used in these two States, their local tax bases are more nearly similar than those in North and South Dakota. As will be apparent later when gross proceeds are included as part of the property tax base, local governments receive considerably more revenue.

State intergovernmental aid systems also vary considerably. North Dakota, for example, places heavy reliance on State aid in financing elementary and secondary education. In Wyoming and South Dakota, on the other hand, the primary source of funds for local schools is the local property tax. Montana's school aid system is quite complex, but relies largely on local property tax revenues which in some instances may be redistributed through the aid system to other districts. These differences in the aid systems are important to any analysis of expected revenues from development. The differences are so important, in fact, that if State aid programs are ignored, quite different impressions about the ability of the school district to finance education are obtained.

The rest of this section presents estimates of the tax revenues and intergovernmental aid available to school districts, counties, and cities. These estimates help identify the levels of government and types of development where financial problems may occur.

School Districts

School district tax revenues in each State were computed by use of 1976 millage rates for districts in a major coal-producing county in that State. Although the school millage would probably decrease in those areas where the mine would add greatly to the assessed value of the district, all estimates were based on existing tax rates to provide a consistent basis for interstate comparisons.

Wyoming school districts would receive an extremely large amount of additional revenue from the new mining development if millage rates remain constant, more than $5,600 per pupil. School districts in Montana would receive almost $1,400 per pupil, while districts in North and South Dakota would receive between $750 and $1,200 per pupil, depending on the State and the size of the mine (table 8).

The sources of new school revenue would vary considerably. In North Dakota, for example, less than a fourth of the total would come from local property taxes, while more than three-fourths would come from increased State aid. This contrasts markedly with Wyoming and South Dakota where less than 5 percent of the new revenue would come from the State. More detail about sources of revenue for school districts can be found in Appendix C. Two points should be noted. First, in Montana and Wyoming where the most local revenue would be generated, the property tax on gross proceeds is by far the largest source of new revenue. Second, in all States, taxes paid by new residents would provide only a small percentage of the total revenue required by the school district.

The estimates were based on the assumption that all workers reside in the school district where the mine is located. If that assumption does not hold, as is often the case, the district in which the mine is located will have even higher per pupil revenues. Other districts with new students but no mine will receive much less revenue per new student.

Per pupil revenue estimates in table 8 are based on the children of workers directly employed by the mine. To the extent that secondary or ancillary employment does not bring with it an equivalent increase in the tax base, new revenues per pupil will be smaller.

Counties

Estimated county revenues from new mine development varied tremendously among the four States. South Dakota counties would receive the least total revenue per new resident while Montana counties would receive the most (table 9). In North Dakota, more than 80 percent of total new revenues for the county would come from State aid, primarily from the portion of the severance tax revenues originating in the county returned by the State. But, in Wyoming and South Dakota, less than 20 percent of county revenues would come from State aid. Wyoming counties would raise more revenue through property taxes than would counties in the other States and it is likely that county millage rates would be reduced as a result of development.

Cities

Because the mines are assumed to be located outside corporate limits, cities

Table 8--Estimated annual school district revenues attributable to mine operation, 1976

State and item	Size of mine (million tons per year)		
	2	5	9.2
	Dollars		
Montana:			
Taxes paid by mine and employees	252,555	572,204	819,649
Less transfer to State equalization fund	199,658	459,088	662,872
Additional State aid	62,393	141,805	189,835
Total net revenue	115,290	254,921	346,613
North Dakota:			
Taxes paid by mine and employees	18,474	32,953	49,282
Additional State aid	58,855	131,955	178,066
Total net revenue	77,329	164,909	227,348
South Dakota:			
Taxes paid by mine and employees	68,770	170,822	283,678
Additional State aid	1/(6,425)	260	19,306
Total net revenue	62,345	171,082	302,984
Wyoming:			
Taxes paid by mine and employees	464,849	1,035,936	1,461,328
Additional State aid	6,765	15,263	20,460
Total net revenue	471,615	1,051,198	1,481,788
Total new revenue per new pupil: 2/			
Montana	1,389	1,371	1,392
North Dakota	932	887	913
South Dakota	751	920	1,217
Wyoming	5,682	5,652	5,950

1/ Provisions of South Dakota's foundation program are such that the total aid available to the school district would decline if the 2-mt mine opened.
2/ Revenue estimates are for new school children directly associated with the opening of the mine.

Note: Totals may not add to detail due to rounding.

Table 9--Estimated annual county revenues attributable to mine operation, 1976

State and tax source	Size of mine (million tons per year)		
	2	5	9.2
		Dollars	
Montana:			
Taxes paid by mine and employees	135,938	303,037	434,853
Additional State aid	84,537	292,733	424,670
Total county revenue	220,475	595,770	859,523
North Dakota:			
Taxes paid by mine and employees	1/ 10,725	2/ 19,134	3/ 28,615
Additional State aid	4/ 58,335	5/ 143,353	6/ 257,695
Total county revenue	69,060	162,487	286,310
South Dakota:			
Taxes paid by mine and employees	32,695	81,217	134,864
Additional State aid	1,959	4,823	7,900
Total county revenue	34,654	86,040	142,764
Wyoming:			
Taxes paid by mine and employees	163,085	363,441	512,683
Additional State aid	30,306	69,563	97,996
Total county revenue	193,391	433,004	610,679
County revenue per new resident: 7/			
Montana	922	1,112	1,197
North Dakota	289	303	399
South Dakota	145	161	199
Wyoming	809	808	851

1/ Includes $2,781 of township taxes.
2/ Includes $4,961 of township taxes.
3/ Includes $7,419 of township taxes.
4/ Includes $397 State aid to township.
5/ Includes $709 State aid to township.
6/ Includes $1,060 State aid to townships.
7/ New residents are employees of the mine and their immediate families.

would receive the least revenue of all units of local government. Tax revenues would come entirely from property taxes and special excise taxes paid by mine employees and their families. In all States but Wyoming, State aid is based either directly or indirectly on population or population change. Since the same family structure and housing choice patterns are assumed for all three model mines, only in Wyoming will per capita revenues for the cities differ depending on the mine size.

All new residents are assumed to locate within a single city. To the extent that individuals choose to live outside the city limits, locally collected revenues and State aid will decrease proportionately. However, in Wyoming where some State aid depends on local sales tax collections, total municipal revenue is not tied directly to the number of new residents living in the city.

Montana cities would receive the most revenue per new resident under these assumptions ($74) and South Dakota cities the least ($24) (table 10). In Wyoming, the largest part of the revenue would come from State aid and local shares of State-collected taxes. In the other three States, most of the revenue would come from taxes paid by mine employees.

The small amount of city revenue per new resident to be generated by mine employees highlights the importance of the tax revenues from the mine. It appears that any local government affected by the impacts of a new mine located outside its boundaries may be faced with serious financial problems. Possible exceptions are school districts in North Dakota and Montana where much of the operating revenue comes from State aid.

CONCLUSIONS

The simulations indicate that considerable tax revenue would be collected from a new mine and its employees in all States, even in South Dakota where no special coal taxes have been enacted. One important question from a policy point of view, however, is whether or not these revenues will be sufficient to cover the costs of the additional government services required by the development. This report presents no direct evidence on that question. Comparisons between the revenue estimates from the simulation and per capita expenditures of States and local governments in the four States studied do provide some insights, however.

Results from the revenue simulations and 1974 expenditures per capita for each level of local government in the four States are compared in table 11. Although there are many problems with using average per capita expenditures to project needs for future local government services, these comparisons do leave certain strong impressions.

First, it appears that total State and local tax revenues are more than sufficient to handle demands for government services by the mine and its employees in all States with the possible exception of South Dakota. In Montana, existing taxes would raise between $11,700 and $17,700 per new resident directly associated with the mine. In North Dakota and Wyoming tax revenues would be between $5,400 and $7,600 per new resident. Ancillary employment associated with the mine development probably will not bring with it anywhere near the same

Table 10--Estimated annual city revenues attributable to mine operation, 1976

State and source of revenue	Size of mine (million tons per year)		
	2	5	9.2
	Dollars		
Montana:			
Taxes paid by mine employees	15,177	33,988	45,531
Additional State aid	2,479	5,552	7,438
Total city revenue	17,656	39,540	52,969
North Dakota:			
Taxes paid by mine employees	7,772	17,187	23,317
Additional State aid	2,773	6,130	8,317
Total city revenue	10,545	23,317	31,634
South Dakota:			
Taxes paid by mine employees	4,195	9,276	12,584
Additional State aid	1,577	3,487	4,728
Total city revenue	5,772	12,763	17,312
Wyoming:			
Taxes paid by mine employees	2,612	5,849	7,836
Additional State aid	11,325	29,983	41,545
Total city revenue	13,937	35,832	49,381
City revenue per new resident: 1/			
Montana	74	74	74
North Dakota	44	44	44
South Dakota	24	24	24
Wyoming	58	67	69

1/ New residents are resident employees of the mine and their immediate families.

Table 11--Estimated annual per capita revenues attributable to mine operation compared with 1974-75 State average per capita expenditures by State and local governments

Revenues and expenditures per government level	Montana	North Dakota	South Dakota	Wyoming
	Dollars			
State government:				
Revenue per new resident 1/	10,084-15,901	5,306-7,531	893-963	2,997-3,359
Average expenditures per capita 2/	483	539	496	589
School districts:				
Revenue per new resident 1/	476-483	308-323	261-423	1,945-2,038
State average expenditures per capita 2/	337	272	265	421
County government:				
Revenue per new resident 1/	922-1,197	275-387	145-199	808-851
State average expenditures per capita 2/	148	96	92	176
City government:				
Revenue per new resident 1/	74	44	24	58-69
State average expenditures per capita 2/	183	223	279	188
Total, State and local government: 1/				
Tax collections per new resident 1/	11,772-17,711	5,507-7,705	1,380-1,536	5,635-6,120
State average expenditures per capita 2/	1,079	1,044	1,001	1,371

1/ New residents are the employees of the mine and their immediate families. The revenue estimates are from the ENERGYTAX model. For details, see Appendix C.

2/ General expenditures of State and local governments are derived from data in U.S. Bureau of the Census, Governmental Finances in 1974-75, GR 75, No. 5, tables 16 and 18.

amount of revenue per capita. Even so, it appears there will be sufficient revenue available to meet the new service needs of State and local governments.

All levels of government are not equally well off, however. State governments, and to a lesser extent the counties, would receive revenues in excess of what might be expected to be their needs. But, the cities appear to be facing a major financial problem. Cities would receive new revenues that are less than one-third average per capita expenditures in 1974-75. Unless the growth in the ancillary or nonbasic sector produces much greater per capita revenues than the mine-related growth, cities are likely to need additional funds.

Special coal-impact funds, administered at the State level, have been established in Montana, North Dakota, and Wyoming. These funds, potential source of aid for the cities, are financed by a fixed percentage of severance tax collections; large sums of money are available annually for projects in impacted areas. The administering agencies are authorized to make grants to local governments with coal-related development problems on a individual project basis. While there is no guarantee that any particular project or request will receive funding, the programs offer some hope to cities and other impacted governmental units. Without this additional aid, however, it appears that either taxes will have to increase or service levels will decline when new mines are developed.

For local schools, probably the level of government of greatest concern, the evidence is unclear except in Wyoming. There it is apparent that the additional revenues will exceed the needs of the school district and that a millage reduction for the entire district will occur. This ignores, of course, the problems of districts that do not contain mines but receive some new residents. Those districts are likely to have financial difficulties because the portion of school revenue which comes from taxes on the individual is quite small.

In other States, more evidence is needed. Although total revenue per new resident for schools is slightly greater than the average expenditure per capita on education in the State, the difference is not great. Moreover, the expenditure figures are for 1974-75 and the revenue estimates from 1976. Consequently, inflation may have further reduced the difference. And, to the extent that the nonbasic sector does not have as much property value per child as the mining sector, the total picture may be even less optimistic. Another problem is that the appropriate cost estimate depends on the capacity and the extent of utilization of the existing school facilities in the particular district under consideration. In districts where class sizes are small and the new students can be accomodated without adding teachers or classrooms, the cost of the additional students will be less than the average for the State. In other situations, however, where the local system is at or near capacity and new physical plant and teachers will have to be added to take care of the increased enrollment, the costs may be considerably above the State average. Without good cost estimates, it is impossible to say whether individual school districts would receive sufficient funds from the new development.

The results of this study, while providing considerable insight into the fiscal-impact issue, leave a number of issues unresolved. There is, for example, a need to extend the model to include the secondary or ancillary economic

growth that accompanies a mine. From the mine owner's point of view, there is no reason that the taxes paid by the mine should be expected to pay for the services demanded by other firms and their employees. But, the planner or the local official may consider it important to know what the situation will be when all the development likely to occur is taken into account. Better information on the costs of expanding State and local government services is also required.

Also, no direct evidence is given on the front-end financing problem. Until the new mine actually comes into full production, the immediate need for new services may outstrip a locality's ability to finance them. Since it can take up to 3 years to ready a coal mine for operation, communities will face more than a temporary financial imbalance. Partial evidence on the extent of that deficit can be obtained from Appendix C. Approximations of the revenue available during the construction period can be found by deducting all net income taxes, severance taxes, and property taxes paid by the mine from the existing totals. In Wyoming, for example, the 9.2-million-ton mine would pay only about $343,000 per year in State and local taxes instead of the $4.4 million estimate for an operating year. Since many State constitutions set limits on local millages and restrict the use of bonding to the financing of capital facilities, the front-end impacts can be difficult to handle. During the construction period, the fiscal deficit for a community is likely to be large and some way of spreading that impact over time is desired. Again, the coal impact funds with their combination of loans and grants can play an important role.

It appears that under the 1976 tax structure, new residents directly associated with the development of a mine need not create major financial problems for State and local governments in the study area. While some redistribution of funds may be required, both through time and among levels of government--through an expanded system of State aid to the cities, for example--sufficient revenues will be generated by existing taxes.

This study does not provide an answer to the question of whether existing State and local taxes are too high from a national point of view. No study can provide a precise answer to that question. Although the revenues appear to be sufficient to cover the direct public sector costs associated with providing services for new employees and their families, those are only part of the external costs that must be considered.

Coal development will also inflict other, less easily measured costs on residents of the region--increases in pollution and congestion, for example--and force changes in lifestyle. Residents of the area should be compensated for these costs, and industry needs to recognize them in their development planning. While it is impossible for mine owners to compensate each resident individually, such compensation can be done through the tax and public expenditure system. By taxing in excess of the costs of new service requirements and either reducing taxes to residents or providing additional services, the States can force the mining firm to take into account external costs and at least partially compensate the region's residents for the changes imposed on them. While this report provides some indication of the relative size of that compensation, we have no evidence on whether it is adequate, excessive, or insufficient in amount.

APPENDIX A: DATA REQUIREMENTS FOR THE ENERGYTAX MODEL

Each State model has slightly different data requirements due to differences in State tax structures. However, input data requirements are similar for all States. Each model requires user-supplied estimates of the number of acres to be mined or held under contract during the year to be simulated, the assessed value per acre of that land, the expected number of tons to be mined annually, and the number of individuals employed during the year to be simulated. The model also requires data on the earnings of the employees. For the ENERGYTAX model, that information is entered as a vector with each element containing the number of workers whose earnings fall in a particular $1,000 range. Total operating costs and the dollar return net of depreciation necessary to produce the prescribed rate of return on discounted cash flow are also required for each simulation.

In the sales tax States--North Dakota, South Dakota, and Wyoming--estimates of equipment purchases and purchases of operating supplies are necessary. Since the coverage of the sales tax varies among States, data on major purchases must be provided separately. Fuel, lubricants, power, tires, and spare parts all may be subject to different tax treatment in different States.

The property tax treatment of the machinery and structures associated with the mine also vary, changing the data requirements of the State models. In North Dakota, only land and structures are taxable, all other personal property is exempt from the property tax. A separate estimate of the value of structures is required for the model for North Dakota. In Montana, equipment classified as motor vehicles is taxed differently than other mining machinery. As a result, separate estimates of motor vehicles and other equipment are necessary. In addition, an estimate of the expected inventory of coal stored at the mine is necessary for Montana.

The user must also supply the millage rates to be used for local property taxes in each State. In Montana, the user is also required to indicate whether the 30-percent or 20-percent severance tax rate should be used. In Wyoming, if the county has chosen to collect a local sales tax, the local sales tax rate must also be indicated.

APPENDIX B: CHARACTERISTICS OF THE MODEL MINES

This appendix provides descriptions of the three model mines, including the various assumptions made regarding their operations and tabulations of estimates of both capital requirements and annual operating costs.

The 2-Million-Ton-Per-Year Lignite Mine

Cost estimates for this model were developed by Skelly and Loy Engineers-Consultants as part of a study for the U.S. Bureau of Mines. 10/ The consulting firm assumed price levels of late 1974 and the wage rates established by the UMW Bituminous Wage Agreement of 1971. For purposes of the current study, these cost estimates were adjusted to price levels prevailing in January 1976 by use of various price indexes. Also, wage rates were assumed to be those established by the UMW Bituminous Wage Agreement of 1974, including the cost-of-living allowance.

This multipit operation is fairly representative of several medium to large lignite strip mines in western North Dakota. Practically all production is exported for electrical power production. The overburden, consisting of unconsolidated clay and scoria, ranges from 10 to 90 feet in thickness, with an average of about 60 feet. Three seams are being mined, which average 6, 12, and 4 feet in thickness, respectively, separated by 5-foot partings.

The topsoil, removed by pan scrapers, is stockpiled and seeded down temporarily to prevent erosion. Because of the nature of the overburden, blasting is not necessary prior to removal. Two relatively small electric-powered draglines -- 12- and 17-cubic-yard buckets -- are used to remove the overburden. The draglines uncover the top seam and then move to another pit. After the top coal seam is extracted, a dragline returns to remove the parting. Both overburden and partings are placed directly into the adjoining cut from which all three coal seams had been removed previously. Some of the scoria is saved for haul-road construction.

A small amount of ANFO (an explosive) is used to blast the lignite seams. Three small electric coal shovels and a front-end loader are used to load the lignite into 65-ton coal haulers for transfer to the coal-preparation plant and tipple. The average haul is about 2 miles to the primary hopper. The lignite goes through primary and secondary crushers before being loaded onto unit trains for transport to electric power plants. It is assumed that the mining company owns the preparation plant and loading facilities.

The disturbed land is regraded to approximately the original contour by use of bulldozers. Topsoil is replaced by use of pan scrapers. Approved mixtures of grasses and legumes are seeded by employees of the mining company. Under the various assumptions made for this mine, production of 2 million tons per year would require strip mining and reclaiming an annual average of 71 acres.

10/ Skelly and Loy Engineers-Consultants. Economic Engineering Analysis of U.S. Surface Coal Mines and Effective Land Reclamation, U.S. Bureau of Mines Contract Rpt. S0241049, Feb. 1975, pp. 9-175 to 9-185.

A total of 71 people are employed at the mine site, 53 of whom are union-wage employees and 18 are salaried professional and administrative people. The dragline operators and oilers are employed in three shifts per day, 7 days per week (340 days per year). Some of the drillers and scraper operators are employed in two shifts per day, 280 days per year, but most of the wage employees are on a one shift per day basis, 280 days per year.

Table B1--Capital investment summary, 2-million-ton-per-year model lignite strip mine, at January 1976 price levels

Item	Quantity	Total cost
	Number	Dollars
Dragline, 17-cu.-yd. bucket (electric powered)	1	1,998,000
Dragline, 12-cu.-yd. bucket (electric powered)	1	1,485,000
Wheel tractor scraper	2	412,300
Self-loading scraper	1	354,920
Bulldozer	5	1,024,290
Drill, coal, 2 3/4"	1	86,400
Drill, hydraulic	1	28,800
Coal shovel, 8-cu.-yd. dipper (elect ic powered)	1	708,750
Coal shovel, 6-cu.-yd. dipper (electric powered)	1	540,000
Coal shovel, 5-cu.-yd. dipper (electric powered)	1	438,750
Front-end loader, 1 1/2-cu.-yd. bucket	1	65,350
Coal haulers, 65-ton capacity	9	2,358,720
Farm tractor, diesel, 100 h.p.	1	19,740
Farm machinery (chisel, plow, harrow, drill)	1(ea)	12,140
Welding machine	4	50,600
Lube truck	1	10,870
Pickup truck	3	16,320
Boom truck	1	16,310
Water truck	1	17,390
Road grader	1	191,740
Air compressor and water truck	1	21,280
Total mining equipment		9,857,670
Coal preparation plant and loading facilities		2,192,950
Exploration, power facilities, site preparation, buildings, and roads		3,230,600
Total direct capital requirements		15,281,220
Field indirect (2 percent of total direct)		305,620
Total construction		15,586,840
Engineering (2.73 percent of total construction)		425,520
Overhead and administration		621,280
Subtotal		16,633,640
Contingency (10 percent of above subtotal)		1,663,360
Subtotal		18,297,000
Fee (2 percent of above subtotal)		365,940
Total mine cost (insurance and tax base)		18,662,940
Interest during construction 1/		559,890
Estimated working capital (from table B5)		927,916
Initial capital investment		20,150,746

1/ Three percent of total mine cost.

Table B2--Manning table, 2-million-ton-per-year model lignite strip mine, at January 1976 wage and salary rates

Personnel	Workers	Basic wage rate per day	Annual wage and salary cost
	No.	--Dollars--	
Wage employees:			
Dragline operator 1/	6	61.88	145,170
Dragline oiler 1/	6	57.68	135,317
Scraper operator 2/	7	57.68	113,052
Bulldozer operator 2/	5	57.68	80,752
Driller 2/	3	54.86	46,083
Driller's helper 2/	3	50.83	42,696
Shovel operator 2/	3	61.88	51,979
Shovel oiler 2/	1	57.68	16,150
Front-end loader operator 2/	1	57.68	16,150
Coal-haul driver 2/	9	54.86	138,247
Preparation-plant operator 2/	1	54.86	15,361
Mechanic 2/	3	59.78	50,215
Welder 2/	1	59.78	16,738
Electrician 2/	1	59.78	16,738
Grader operator 2/	1	51.86	15,361
Sprinkler-truck driver 2/	1	50.83	14,232
Revegetation equipment operator 3/	1	54.86	7,681
Total wage employees	53		921,922
Supervisory and professional workers:			
Superintendent	1		30,600
General mine foreman	1		20,600
Pit foreman	3		48,600
Mining engineer	1		23,600
Assistant engineer	1		21,200
Reclamation foreman	1		17,700
Electrical foreman	1		18,900
Maintenance superintendent	1		23,600
Maintenance foreman	2		37,800
Purchasing agent	1		17,700
Warehouseman	2		23,600
Timekeeper	1		11,800
Bookkeeper	1		11,800
Clerk-steno	1		7,000
Total supervisory and professional workers	18		314,500
Total all resident workers	71		1,236,422

1/ Employed 340 days per year.
2/ Employed 280 days per year.
3/ Employed 140 days per year.

Table B3--Depreciation schedule, 2-million-ton-per-year model lignite strip mine, at January 1976 price levels

Item	Quantity	Useful life	Yearly charge 1/
	No.	Years	Dollars
Dragline, 17-cu.-yd. bucket	1	20	99,900
Dragline, 12-cu.-yd. bucket	1	20	74,250
Wheel tractor scraper	2	6	68,720
Self-loading scraper	1	10	35,490
Bulldozer	5	10	102,430
Drill, coal, 2 3/4"	1	20	4,320
Drill, hydraulic	1	20	1,440
Coal shovel, 8-cu.-yd. dipper	1	20	35,440
Coal shovel, 6-cu.-yd. dipper	1	20	27,000
Coal shovel, 5-cu.-yd. dipper	1	20	21,940
Front-end loader, 1 1/2-cu.-yd. bucket	1	10	6,540
Coal haulers, 65-ton capacity	9	8	294,840
Farm tractor, diesel, 100 h.p.	1	10	1,970
Farm machinery (plow, harrow, drill)	1(ea)	10	1,210
Welding machine	4	10	5,060
Lube truck	1	10	1,090
Pickup truck	3	4	4,080
Boom truck	1	10	1,630
Water truck	1	10	1,740
Road grader	1	10	19,170
Air compressor and water truck	1	10	2,130
Coal preparation plant and loading facilities	1	20	109,650
Exploration, power facilities, site preparation, buildings, and roads		20	161,640
Depreciation for field indirect, engineering, overhead and administration, contingency, fee, interest during construction		20	197,110
Interim equipment cost		20	100,080
Total annual depreciation charge			1,378,870

1/ Depreciation computed by straight-line method, with no salvage value assumed at end of useful life.

Table B4--Estimated annual operating cost, 2-million-ton-per-year model lignite strip mine, at January 1976 price levels

Item	Annual cost
	Dollars
Direct costs	
Labor	921,922
Supervision	314,500
Total labor and supervision	1,236,422
Operating supplies:	
Fuel	152,380
Lubricants	5,710
Explosives (ANFO)	25,000
Parts, materials, and miscellaneous	1,107,140
Total operating supplies	1,290,230
Miscellaneous:	
Power	111,890
Communications	38,000
Union welfare	885,600
Payroll overhead	432,748
Health and safety	20,000
Royalty	1,000,000
Strip license and reclamation fee	49,790
Total miscellaneous	2,538,028
Total direct cost	5,064,680
Indirect cost	
15% of labor, supervision, and operating supplies	378,998
Fixed cost 1/	
Insurance	150,000
Depreciation	
From table B3	1,378,870
Total annual operating cost	6,972,548

1/ State and local taxes are computed within the ENERGYTAX model.

Table B5--Estimated working capital and total capital investment, 2-million-ton-per-year model lignite strip mine, at January 1976 price levels

Item	Amount
	Dollars
Estimated working capital:	
Direct labor, 3 months	309,106
Operating supplies, 3 months	322,558
Payroll overhead, 3 months	108,187
Indirect costs, 3 months	94,750
Fixed cost (0.5 percent of insurance base)	93,315
Total estimated working capital	927,916
Total capital investment:	
Total mine cost (insurance, tax base)	18,662,940
Interest during construction	559,890
Total estimated working capital (from above)	927,916
Estimated initial capital investment	20,150,746
Estimated deferred capital investment	9,740,290
Total capital and deferred investment	29,891,036

Table B6--Summary of discounted investment costs, 2-million-ton-per-year model lignite strip mine at January 1976 price levels

Year	Capital investment	Present worth factor at 15 percent	Present worth of capital investment
	Dollars	Factor	Dollars
0	20,150,746	1.0000	20,150,746
1	100,000	.8696	86,960
2	100,000	.7561	78,610
3	100,000	.6578	65,780
4	116,320	.5718	66,512
5	100,000	.4972	49,720
6	512,320	.4323	221,476
7	100,000	.3759	37,590
8	2,475,040	.3269	809,090
9	100,000	.2843	28,430
10	1,784,610	.2472	441,155
11	100,000	.2149	21,490
12	528,640	.1869	98,803
13	100,000	.1625	16,250
14	100,000	.1414	14,140
15	100,000	.1229	12,290
16	2,475,040	.1068	264,334
17	100,000	.0930	9,300
18	512,320	.0808	41,395
19	100,000	.0702	7,020
20	-1,455,514	.0611	-88,932

Total present worth of capital investment = $22,432,160

Return = $22,429,160 ÷ 6.2593 = $3,583,812
Less depreciation 1,378,870
Net profit and depletion $2,204,942

The 5-Million-Ton-Per-Year Subbituminous Mine

The cost estimates for this model were developed by Skelly and Loy Engineers-Consultants in the same study noted previously for the 2-million-ton-per-year lignite mine. 11/ These estimates were also adjusted to price levels of January 1976 by use of various price indexes for purposes of the current study.

This model is fairly typical of the medium-sized subbituminous strip mines in eastern Montana and northeastern Wyoming. The coal seam is nearly level with an average thickness of 52 feet. Because of the properties of the coal (heat value of 9,600 Btu's per pound, ash content of 3.7 percent, and sulfur content of only 0.33 percent), it is in great demand at Midwest electric generating plants for blending with high sulfur Midwest coal. The overburden, which ranges up to 150 feet in thickness with an average of about 65 feet, consists of sandy alluvial till, interbedded with clay, sandstone, and shale.

Topsoil is removed and stockpiled by use of pan scrapers. Since the overburden is fairly well consolidated, it is blasted with ANFO prior to removal. Blast holes are 12¼ inches in diameter on 30-foot spacings. The overburden is removed by an electric-powered dragline, equipped with a 41-cubic-yard bucket, and placed in the adjacent, previously mined cut. The coal is blasted with ANFO (6-inch holes on 16-foot centers). The coal is loaded with two electric coal shovels, equipped with 26-yard dippers, into 70-ton bottom dump coal haulers. Because of seam thickness, benching into two 26-foot lifts is required. A front-end loader is used for cleanup and auxiliary loading.

The coal is crushed at the preparation plant to a top size of 2 inches. The plant has a capacity of 2,000 tons per hour. Storage is in two 13,000-ton silos. The coal is flood-loaded onto 100-car unit trains for shipment to Midwest utility plants. The coal is electronically weighed and automatically sampled during loading. A 10,000-ton train can be loaded in about 2 hours.

The disturbed land is regraded to smooth contours by large bulldozers. The topsoil is replaced by use of pan scrapers and seeded down with approved grasses and legumes by use of a hydroseeder. This implement applies seed and fertilizer as a slurry and lays down a straw mulch in one operation.

A high coal-recovery rate of at least 90 percent can be assumed because of the thickness of the coal seam. At this rate, the estimated coal yield would average 81,900 tons per acre. An annual production of 5 million tons would mean an average of 61 acres to be mined and reclaimed each year.

A total of 157 people are employed at the mine site, 117 of whom are union wage employees and 40 are professional and administrative personnel. The dragline operators and oilers are organized into three shifts per day, 7 days per week (345 days per year). Most of the other miners are on a two-shift per day basis, 6 days per week (295 days per year), although a few are on the basis of one-shift per day, 240 days per year. Average employee earnings are relatively high because so much overtime is worked.

11/ Skelly and Loy Engineers-Consultants, op. cit., pp. 9-164 to 9-174.

Table B7--Capital investment summary, 5-million-ton-per-year model subbituminous mine, at January 1976 price levels

Item	Quantity	Total cost
	Number	Dollars
Dragline, 41-cu.-yd. bucket (electric powered)	1	5,130,000
Coal shovel, 16.-cu.-yd. dipper (electric powered)	2	2,673,000
Pan scraper	2	458,140
Bulldozer	3	674,820
Front-end loader	1	169,030
Coal hauler, 70-ton capacity	8	1,863,760
Coal hauler, 120-ton capacity	1	396,050
Road grader	2	133,780
Hydroseeder	1	58,560
Coal drill	1	547,210
Drill (exploration)	1	547,210
Explosive truck	1	10,870
Fertilizer truck	1	65,230
Fuel truck	1	10,870
Water truck	1	65,230
Total mining equipment		12,803,760
Coal preparation plant		5,382,500
Unit-train loading facilities		3,858,000
Exploration, power facilities, site preparation, buildings, and roads		3,646,730
Total direct capital requirements		25,690,990
Field indirect (2 percent of total direct)		513,820
Engineering (4.07 percent of total direct)		1,045,620
Overhead and administration 1/		930,010
Subtotal		28,180,440
Contingency (10 percent of above subtotal)		2,818,040
Subtotal		30,998,480
Fee (2 percent of above subtotal)		619,970
Total mine cost (insurance, tax base)		31,618,450
Interest during construction 2/		948,550
Estimated working capital (table B11)		2,280,710
Initial capital investment		34,847,710

1/ 3.62 percent of total direct cost.
2/ 3.0 percent of total mine cost.

Table B8--Manning table, 5-million-ton-per-year model subbituminous strip mine, at January 1976 wage and salary rates

Personnel	Workers	Basic wage rate per day	Annual wage and salary cost
	Number	Dollars	
Wage employees:			
Dragline operator 1/	3	61.88	73,653
Dragline oiler 1/	3	57.68	68,654
Shovel operator 2/	4	61.88	73,018
Shovel oiler 2/	4	57.68	68,062
Front-end loader operator 2/	2	57.68	34,031
Scraper operator 3/	4	57.68	55,056
Bulldozer operator 2/	6	57.68	102,094
Bulldozer operator 3/	2	57.68	27,685
Driller 2/	2	54.86	32,367
Driller's helper 2/	2	50.83	29,990
Driller 3/	2	54.86	26,333
Driller's helper 3/	2	50.83	24,398
Drill hand 3/	4	49.86	47,866
Shooter 3/	2	54.86	26,333
Truck driver	6	50.83	89,969
Coal-haul operator 2/	18	54.86	291,307
Preparation-plant operator 2/	2	54.86	32,367
Preparation man 2/	4	50.83	59,979
Hydroseeder operator 4/	1	54.86	6,035
Grader operator 2/	4	54.86	64,735
Truck drivers, maintenance 2/	6	50.83	89,969
Mechanic and machinist 2/	14	59.78	246,891
Mechanic's helper 2/	2	51.42	30,338
Electrician 2/	4	59.78	70,540
Electrician's helper 2/	2	51.42	30,338
Welder	4	59.78	70,540
Serviceman	2	51.42	30,338
Utility man, helper	6	50.83	89,969
Total wage employees	117		1,892,856
Supervisory and professional workers:			
General manager	1		31,200
Mine superintendent	2		50,400
Shift supervisor	6		135,480
Mining engineer	1		24,000
Assistant mining engineer	2		39,920
Engineering aide	1		17,000
Surveyor	1		20,400

Continued

See footnotes at end of table.

Table B8--Manning table, 5-million-ton-per-year model subbituminous strip mine, at January 1976 wage and salary rates--Continued

Personnel	Workers	Basic wage rate per day	Annual wage and salary cost
	Number	Dollars	
Geologist	1		15,600
Maintenance superintendent	1		27,000
Maintenance foreman, mechanic	3		71,640
Electrical superintendent	1		23,040
Electrical foreman	1		20,275
Welding foreman	1		20,275
Haulway foreman	2		39,860
Safety inspector	3		53,475
Reclamation specialist	1		19,260
Office manager	1		18,810
Purchasing agent	1		18,810
Warehouse supervisor	1		16,850
Warehouseman	3		34,200
Timekeeper	1		13,200
Bookkeeper	1		13,200
Typist	2		16,400
Mine clerk	1		12,100
Custodian	1		9,130
Total supervisory and professional workers	40		761,525
Total resident workers	157		2,654,381

1/ 345 days per year.
2/ 295 days per year.
3/ 240 days per year.
4/ 110 days per year.

Table B9--Depreciation schedule, 5-million-ton-per-year subbituminous strip mine, at January 1976 price levels

Item	Quantity	Useful life	Yearly charge 1/
	Number	Years	Dollars
Dragline, 41-cu.-yd. bucket (electric)	1	20	256,500
Coal shovel, 16-cu.-yd. dipper (electric)	2	20	133,650
Pan scraper	2	5	91,630
Bulldozer	3	5	134,960
Front-end loader	1	5	33,810
Coal hauler, 70-ton capacity	8	5	374,750
Coal hauler, 120-ton capacity	1	5	79,210
Road grader	2	10	13,380
Hydroseeder	1	5	11,710
Coal drill	1	5	109,440
Drill (exploration)	1	5	109,440
Explosive truck	1	3	3,620
Fertilizer truck	1	5	13,050
Fuel truck	1	3	3,620
Water truck	1	5	13,050
Exploration, power facilities, site preparation, buildings, and roads		20	182,340
Preparation plant		20	269,130
Unit-train loading facilities		20	192,900
Depreciation for field indirect, engineering, contingency, fee, and overhead and administration, interest during construction		20	343,800
Interim equipment cost		20	253,390
Total annual depreciation cost			2,623,380

1/ Depreciation computed by straight-line method, with no salvage value assumed at end of useful life.

Table B10--Estimated annual operating cost, 5-million-ton-per-year subbituminous strip mine, at January 1976 price levels

Cost item	Annual cost
	Dollars
Direct costs	
Labor	1,892,856
Supervision	761,525
Total labor and supervision	2,654,381
Operating supplies:	
Fuel	352,050
Lubricants	13,180
Explosives (ANFO)	324,000
Parts, materials, and miscellaneous	3,044,440
Total operating supplies	3,733,670
Miscellaneous:	
Power	313,290
Communications	60,000
Union welfare	4,428,000
Payroll overhead	929,033
Health and safety	300,000
Royalty	1,400,000
Strip license and reclamation fee	3,000
Total miscellaneous	7,433,323
Total direct cost	13,821,374
Indirect cost	
15 percent of labor, supervision, and operating supplies	958,208
Fixed cost 1/	
Insurance	300,000
Depreciation	
From table B9	2,623,380
Total annual operating cost	17,702,962

1/ State and local taxes are computed within the ENERGYTAX model.

Table B11--Estimated working capital and total capital investment, 5-million-ton-per-year model subbituminous strip mine, at January 1976 price levels

Item	Amount
	Dollars
Estimated working capital:	
Direct labor, 3 months	663,595
Operating supplies, 3 months	232,258
Payroll overhead, 3 months	933,418
Indirect costs, 3 months	239,552
Fixed cost (0.5% of insurance base)	158,092
Miscellaneous	53,792
Total working capital	2,280,707
Total capital investments:	
Total mine cost (insurance, tax base)	31,618,450
Interest during construction	948,550
Total estimated working capital (from above)	2,280,707
Estimated initial capital investment	34,847,707
Estimated deferred capital investment	19,897,670
Total capital and deferred investment	54,745,377

Table B12--Summary of discounted investment costs, 5-million-ton-per-year model subbituminous strip mine, at January 1976 price levels

Year	Capital investment	Present worth factor at 15 percent	Present worth of capital investment
	Dollars	Factor	Dollars
0	34,847,707	1.0000	34,847,707
1	253,390	.8696	220,348
2	253,390	.7561	191,588
3	275,110	.6575	180,885
4	253,390	.5718	144,888
5	5,108,640	.4972	2,540,016
6	275,110	.4323	118,930
7	253,390	.3759	95,249
8	253,390	.3269	82,833
9	275,110	.2844	78,241
10	5,175,540	.2472	1,279,393
11	253,390	.2149	34,453
12	275,110	.1869	51,418
13	253,390	.1625	41,176
14	253,390	.1414	35,829
15	5,197,260	.1229	638,743
16	253,390	.1068	27,062
17	253,390	.0930	23,565
18	275,110	.0808	22,229
19	253,390	.0702	17,788
20	-2,623,380	.0611	-160,289

Total present worth of capital investment $40,532,052

Return = $40,532,052 ÷ 6.2593 = $6,475,493
Less depreciation 2,623,380
Net profit and depletion $3,852,113

The 9.2-million-Ton-Per-Year Subbituminous Mine

This model was one of three prepared originally in 1974 by the U.S. Bureau of Mines to illustrate what would be required to provide feedstocks for a mine-mouth, coal gasification plant with a daily capacity of 250 million cubic feet of pipeline quality gas. 12/ Costs of materials and equipment were based on

12/ Sidney Katell and E.L. Hemingway. Basic Estimated Capital Investments and Operating Costs for Coal Strip Mines, U.S. Bur. Mines, Inf. Circ. 8661, Wash., D.C., 1974.

1973 and early 1974 indexes. Wages and union welfare payments were assumed to be as of May 12, 1974, under the Bituminous Wage Agreement of 1971. Subsequently, the cost estimates for materials and equipment were adjusted for inflation by use of 1975 indexes. Wages and union welfare payments were changed in accordance with the Bituminous Wage Agreement of 1974. 13/ The current study adjusted these cost estimates to price levels of January 1976 by use of appropriate price indexes.

This large multipit mine is assumed to be located in the Powder River Basin of either Montana or Wyoming. Only one mine as large as this model is now being operated in this region, but several export mines, now being developed, will be as large or larger.

The coal is of subbituminous rank, with 9,600 Btu's per pound and low ash and sulfur content. The coal seam is fairly level and averages 25 feet in thickness, with an average of 70 feet of overburden. Topsoil is removed and stockpiled by use of wheel tractor scrapers. Both overburden and coal are blasted with ANFO prior to removal. The two overburden drills are expensive, electric-powered pieces of equipment, capable of drilling holes of 9-inch to 15-inch diameter. Two smaller, lighter drills are used for drilling the coal. The blasted overburden is removed by two large electric-powered draglines and placed directly in the adjoining, mined-out cuts. The drills and draglines are backed up by bulldozers and wheel tractor scrapers.

Two electric-powered coal shovels, equipped with 15-cubic-yard dippers, load the coal into bottom-dump, 120-ton coal haulers. A 15-cubic-yard front-end loader works with each shovel for cleanup and auxiliary loading. The run-of-the-mine coal is hauled directly to stockpiles at the gasification plant without any preparation. Haul-roads are maintained by graders and bulldozers. Sprinkling trucks are used to keep down the dust.

At an assumed recovery rate of 90 percent, coal production will average 39,375 tons per acre. To produce 9.2 million tons per year would require an annual average of 233 acres for both mining and reclamation. Bulldozers are used to regrade the spoil banks to a gently rolling contour. Topsoil is replaced by use of wheel tractor scrapers. The rest of the reclamation work (seeding, fertilization, and mulching) is contracted out.

The work force at the mine site totals 213, of whom 189 are union wage employees and 24 are professional and administrative personnel. The dragline operators and oilers are assumed to work in three shifts per day, 7 days per week, (345 days per year). Most of other mining and maintenance employees work in two shifts per day, 5 days per week (240 days per year).

13/ Sidney Katell, E.L. Hemingway, and L.H. Berkshire. Basic Estimated Capital Investment and Operating Costs for Coal Strip Mines (Revision of Inf. Cir. 8661), U.S. Bur. Mines, Inf. Circ. 8707, Wash., D.C., 1976.

Table B13--Capital investment summary, 9.2-million-ton-per-year model subbituminous strip mine, at January 1976 price levels

Item	Quantity	Total cost
	No.	Dollars
Mining machinery and equipment:		
Dragline, 45-cu.-yd. bucket (electric powered)	2	12,353,200
Coal shovel, 15-cu.-yd. dipper (electric powered)	2	3,187,900
Cable handler and reel	2	187,100
Bulldozer, 385 fwhp	10	1,636,800
Wheel tractor scraper, 400 fwhp	10	2,851,000
Front-end loader	2	759,200
Overburden drill (9" to 15" holes, bit loading, 110,000)	2	1,242,200
Coal drill	2	74,100
Coal hauler	15	4,720,100
Road grader	2	185,000
Water truck	1	45,900
Lubrication service truck	1	43,000
Mechanic truck	2	24,900
Welding truck	2	20,400
Electrician truck	2	20,400
Supply truck	1	9,600
Explosives truck	2	51,000
Pickup truck	6	38,300
Forklift	1	9,400
Crane truck	1	125,600
Pump, portable	6	22,300
Communications equipment		15,800
Total mining machinery and equipment		27,623,200
Power facilities:		
Flood lights and towers		21,600
Substation, 10,000 KV-A	4	484,800
Disconnect skid	8	97,300
Breaker skid	8	205,400
Substation, 1,000 KV-A	4	90,900
Substation, 150 KV-A	2	34,200
Connection box	15	24,300
Power cable		945,900
Total power facilities		1,904,400

Continued

Table B13--Capital investment summary, 9.2-million-ton-per-year model subbituminous strip mine, at January 1976 price levels--Continued

Item	Quantity	Total cost
	No.	Dollars
Structures:		
Office and warehouse		351,000
Explosive storage facilities		54,000
Shop and warehouse		1,188,100
Oil and fuel storage facilities		31,900
Total structures		1,625,000
Miscellaneous:		
Initial road construction		136,000
Site preparation		108,800
Exploration		163,200
Total miscellaneous		408,000
Total direct capital requirements		31,560,600
Field indirect (2 percent of total direct)		631,200
Total construction		32,191,800
Engineering		643,800
Overhead and administration		1,641,800
Subtotal		34,477,400
Contingency (15 percent of above subtotal)		5,171,600
Subtotal		39,649,000
Fee (2 percent of above subtotal)		793,000
Total mine cost (insurance and tax base)		40,442,000
Interest during construction 1/		2,022,100
Estimated working capital (from table B17)		3,074,500
Initial capital investment		45,538,600

1/ 5 percent of total mine cost.

Table B14--Manning table, 9.2-million-ton-per-year model subbituminous strip mine, at January 1976 wage and salary rates

Personnel	Workers	Basic wage rate per day	Annual wage and salary cost
	No.	Dollars	
Union wage employees:			
Dragline operator 1/	6	61.88	157,963
Dragline oiler 1/	6	57.68	147,504
Shovel operator 3/	4	61.88	55,073
Shovel oiler 3/	4	57.68	51,335
Front-end loader operator 3/	4	57.68	51,335
Wheel scraper operator 2/	16	57.68	204,922
Bulldozer operator 4/	18	57.68	301,457
Driller 2/	8	54.86	97,799
Driller's helper 2/	8	50.83	90,623
Shooter 3/	6	54.86	72,963
Pitman (coal) 3/	4	50.83	45,239
Truck driver (explosives) 3/	2	54.86	24,138
Coal-haul driver 3/	28	54.86	342,162
Road grader operator 2/	4	54.86	48,900
Water truck driver 2/	2	54.86	24,536
Lubrication truck driver 2/	6	50.83	68,478
Supply truck driver 2/	6	50.83	68,478
Mechanic 2/	18	59.78	241,132
Electrician 2/	9	59.78	120,506
Machinist 2/	9	59.78	120,506
Welder 2/	9	59.78	120,506
Utility man 2/	12	50.83	135,949
Total wage employees	189		2,591,504
Supervisory and professional workers:			
Superintendent	1	---	31,580
General pit foreman	2	---	43,560
Pit foreman	6	---	107,820
Maintenance superintendent	1	---	23,960
Maintenance foreman	3	---	54,450
Mining engineer	1	---	23,960
Safety inspector	3	---	47,370
Office manager	1	---	16,880
Purchasing agent	1	---	16,880
Timekeeper	1	---	11,980
Bookkeeper	1	---	11,980
Warehouseman	3	---	32,670
Total supervisory and professional workers	24		423,090
Total all resident workers	213		3,014,594

1/ Employed 345 days per year.
2/ Employed 220 days per year.
3/ Employed 240 days per year.
4/ Ten are employed 345 days per year and 8 are employed 220 days per year.

Table B15--Depreciation schedule, 9.2-million-ton-per-year model subbituminous strip mine, at January 1976 price levels

Item	Quantity	Useful life	Salvage value at end of useful life	Yearly charge 1/
	No.	Years	Percent	Dollars
Dragline	2	20	0	617,660
Coal shovel	2	20	0	159,400
Cable handler and reel	2	20	0	9,360
Bulldozer	10	10	0	163,680
Wheel tractor scraper	10	5	9.0	518,880
Front-end loader	2	5	7.0	141,210
Overburden drill	2	10	0	124,220
Coal drill	2	10	0	7,410
Coal hauler	15	7	10.0	606,870
Road grader	2	10	15.0	15,730
Water truck	1	10	5.0	4,360
Lubrication service truck	1	10	12.5	3,760
Mechanic truck	2	5	15.0	4,230
Welding truck	2	5	15.0	3,470
Electrician truck	2	5	15.0	3,470
Supply truck	1	5	33.3	1,280
Explosives truck	2	5	10.0	9,180
Pickup truck	6	3	10.0	11,490
Fork lift	1	5	7.5	1,740
Crane truck	1	10	12.5	10,990
Pump, portable	6	10	0	2,230
Communications equipment		10	0	1,580
Floodlights and towers		10	0	2,160
Power cable		5	0	189,180
Other power facilities		20	0	46,850
Structures and buildings		20	0	81,250
Initial road construction		20	0	6,800
Site preparation		20	0	5,440
Exploration		20	0	8,160
Interim equipment replacement		20	0	584,770
Depreciation for field indirect, engineering, overhead and administration, contingency, fee, and interest during construction		20	0	547,680
Total annual depreciation				3,894,490

1/ Depreciation computed by the straight-line method, with allowance for salvage value at end of useful life.

Table B16--Estimated annual operating cost, 9.2-million-ton-per-year model subbituminous strip mine, at January 1976 price levels

Cost items	Annual cost
	Dollars
Direct costs	
Labor	2,591,500
Supervision	423,090
Total labor and supervision	3,014,590
Operating supplies:	
Fuel	1,321,900
Lubricants	48,120
Explosives (ANFO)	1,196,000
Drill bits	279,200
Spare parts	498,430
Tires	562,640
Miscellaneous	482,880
Total operating supplies	4,389,170
Miscellaneous:	
Power	1,231,600
Reclamation (contract for mulching, fertilizing, and seeding)	423,210
Payroll overhead (40 percent of payroll)	1,205,840
Union welfare	8,147,970
Royalty, strip license, and rent	2,216,000
Total miscellaneous	13,224,620
Total direct cost	20,628,380
Indirect cost	
15 percent of payroll and supplies	1,110,560
Fixed cost 1/	
Insurance	500,000
Depreciation	
From table B15	3,894,490
Total annual operating cost	26,133,430

1/ State and local taxes are computed within the ENERGYTAX model.

Table B17--Estimated working capital and total capital investment, 9.2-million-ton-per-year model subbituminous strip mine, at January 1976 price levels

Item	Amount
	Dollars
Estimated working capital:	
Direct labor, 3 months	753,600
Operating supplies, 3 months	1,097,300
Payroll overhead, 3 months	301,500
Indirect cost, 4 months	370,200
Fixed cost (0.5 percent of insurance base)	202,200
Spare parts	245,600
Miscellaneous	104,100
Total estimated working capital	3,074,500
Total capital investment:	
Total mine cost (insurance, tax base)	40,442,000
Interest during construction	2,022,100
Total estimated working capital (from above)	3,074,500
Estimated initial capital investment	45,538,600
Estimated deferred capital investment	38,852,960
Total capital and deferred investment	84,391,560

Table B18--Summary of discounted investment costs, 9.2-million-ton-per-year model subbituminous strip mine, at January 1976 price levels

Year	Capital investment	Present worth factor at 15 percent	Present worth of capital investment
	Dollars	Factor	Dollars
-1	18,189,880	1.1500	20,918,362
0	27,348,720	1.0000	27,348,720
1	584,770	.8696	508,514
2	584,770	.7561	442,143
3	623,070	.6575	409,669
4	584,770	.5718	252,817
5	5,276,570	.4972	2,623,511
6	623,070	.4323	269,353
7	5,304,800	.3759	1,994,074
8	584,770	.3269	191,161
9	623,070	.2843	177,139
10	8,688,870	.2472	2,147,889
11	584,770	.2149	125,667
12	623,070	.1869	116,452
13	584,770	.1625	95,025
14	5,304,800	.1413	749,568
15	5,314,870	.1229	653,198
16	584,770	.1069	62,453
17	584,770	.0929	54,325
18	623,070	.0808	50,344
19	584,770	.0703	41,109
20	-3,071,575	.0611	-187,673

Total present worth of capital investment $59,043,820.

Return = $59,043,820 ÷ 6.2593 =	$9,432,975
Less depreciation	3,894,490
Net profit and depletion	5,538,485

APPENDIX C: DETAILED RESULTS FROM THE ENERGYTAX SIMULATION

Table C1--Montana: Estimated annual State tax payments by model mines and their employees, 1976

Type of tax	Size of mine (million tons per year)		
	2	5	9.2
		Dollars	
Taxes paid by mine			
Property taxes:			
Mining claim	81	73	73
Equipment	3,703	6,389	8,633
Gross proceeds of mines	26,627	61,319	88,837
Total property taxes	30,411	67,781	97,543
Corporate income tax	163,623	288,552	412,367
Severance tax	2,092,125	7,270,638	10,552,883
Resource indemmity trust tax	52,303	121,177	175,881
Unemployment insurance	10,565	23,659	31,695
Filing fees	5	5	5
Total State taxes paid by mine	2,349,032	7,771,812	11,270,374
Taxes paid by mine employees			
Property taxes:			
Mobile homes	36	80	108
Owned homes	988	2,212	2,963
Rental housing	185	413	554
Motor vehicles	99	223	298
Total property taxes	1,308	2,928	3,923
Personal income tax	42,755	88,510	92,303
Cigarette tax	2,868	6,422	8,602
Alcohol excise tax	2,676	5,992	8,027
Liquor store profits	2,049	4,588	6,147
Motor vehicle registration	1,116	2,500	3,349
Motor fuels tax	7,947	17,796	23,840
Total State taxes paid by mine employees	60,719	128,736	146,191
Total State taxes paid by mine and its employees	2,409,751	7,900,548	11,416,565

Table C2--Montana: Estimated annual net revenue to State government attributable to model mines and their employees, 1976

Source of revenue	Size of mine (million tons per year)		
	2	5	9.2
	Dollars		
Total State tax payments by mine and its employees	2,409,751	7,900,548	11,416,565
County equalization revenue	199,659	459,088	662,872
Total State revenues	2,609,410	8,359,636	12,079,437
Apportionments:			
State aid to local government	149,409	440,090	621,944
Alternative energy research and development fund	52,303	181,766	263,822
Local impact and education trust fund	575,334	1,999,425	2,902,043
Coal area highway development fund	209,212	727,064	1,055,288
School equalization fund	209,212	727,064	1,055,288
County land planning	20,921	72,706	105,528
Renewable resource development fund	52,303	181,766	263,822
Parks	52,303	181,766	263,822
Resource indemnity trust	52,303	121,177	175,881
Total amount for State aid and earmarked funds	1,373,300	4,632,824	6,707,438
Net amount to State general fund	1,236,110	3,726,812	5,371,999

Table C3--Montana: Estimated annual revenues of school districts attributable to model mines and their employees, 1976

Source of revenue	Size of mine (million tons per year) 2	5	9.2
	Dollars		
Equalization funds			
County equalization levy	199,658	459,088	662,872
Less transfer to State equalization	137,265	317,283	473,036
Total county equalization aid	62,393	141,805	189,836
Property taxes, permissive levy			
Paid by mine:			
Mining claim	89	76	72
Mining equipment	4,093	6,627	8,483
Gross proceeds of mines	29,427	63,603	87,293
Total paid by mine	33,609	70,306	95,848
Paid by mine employees:			
Mobile homes	39	83	105
Owned homes	1,092	2,294	2,911
Rental housing	204	429	545
Motor vehicles	110	231	293
Total paid by employees	1,445	3,037	3,854
Total permissive levy	35,054	73,343	99,702
Property taxes, voted levy			
Paid by mine:			
Mining claim	45	41	41
Mining equipment	2,083	3,594	4,856
Gross proceeds of mines	14,978	34,491	49,971
Total paid by mine	17,106	38,126	54,868
Paid by mine employees:			
Mobile homes	20	45	60
Owned homes	556	1,244	1,667
Rental housing	104	233	312
Motor vehicles	56	125	168
Total paid by employees	736	1,647	2,207
Total voted levy	17,842	39,773	57,075
Total school district revenues	115,289	254,921	346,613

Table C4--Montana: Estimated annual revenues of county governments attributable to model mines and their employees, 1976

Source of revenue	Size of mine (million tons per year)		
	2	5	9.2
	Dollars		
Property taxes paid by mine:			
Mining claim	346	312	312
Mining equipment	15,872	27,382	36,999
Gross proceeds of mines	114,116	262,794	380,731
Total property taxes paid by mine	130,334	290,488	418,042
Property taxes paid by employees:			
Mobile homes	154	343	460
Owned homes	4,233	9,479	12,698
Rental housing	792	1,773	2,375
Motor vehicles	426	954	1,278
Total property taxes paid by employees	5,605	12,549	16,811
Total property taxes paid by mine and its employees	135,939	303,037	434,853
Apportionments from State funds:			
Highway aid	754	1,688	2,261
Coal tax rebate	83,685	290,825	422,115
Liquor tax rebate	98	219	294
Total apportionments from State funds	84,537	292,732	424,670
Total county government revenues	220,476	595,769	859,523

Table C5--Montana: Estimated annual revenues of city governments attributable to model mines and their employees, 1976

Source of revenue	Size of mine (million tons per year)		
	2	5	9.2
		Dollars	
Property taxes paid by mine	0	0	0
Taxes paid by mine employees			
Property taxes:			
Mobile homes	415	930	1,246
Owned homes	11,464	25,672	34,391
Rental housing	2,144	4,802	6,433
Motor vehicles	1,154	2,584	3,461
Total property taxes paid by employees	15,177	33,988	45,531
Total property taxes paid by the mine and its employees	15,177	33,988	45,531
Apportionments from State funds			
Highway aid	1,499	3,357	4,497
Beer tax distribution	686	1,537	2,060
Liquor tax rebate	294	658	881
Total apportionments from State funds	2,479	5,552	7,438
Total city government revenue	17,656	39,540	52,969

Table C6--North Dakota: Estimated annual State tax payments by model mines and their employees, 1976

Type of tax	Size of mine (million tons per year)		
	2	5	9.2
	Dollars		
Taxes paid by mine			
Property taxes	5	4	4
Sales tax:			
Equipment	4,400	10,136	23,391
Supplies	49,990	147,796	171,955
Severance tax	1,040,000	2,600,000	4,784,000
Corporate income tax	70,152	123,608	176,588
Business privilege tax	21,995	38,803	55,462
Unemployment insurance	12,524	28,048	37,573
Fees	700	665	665
Total State taxes paid by mine	1,199,766	2,949,060	5,249,638
Taxes paid by mine employees			
Property taxes:			
Mobile homes	4	10	13
Owned homes	98	217	294
Rental housing	20	44	60
Total property taxes	122	271	367
Personal income tax	34,177	68,400	60,285
Cigarette and tobacco tax	2,399	5,304	7,196
Alcohol excise tax	1,808	3,999	5,425
General sales tax	12,014	25,947	30,848
Automobile registration	9,176	20,290	27,527
Motor fuels taxes	8,605	19,028	25,814
Total State taxes paid by mine employees	68,301	143,239	157,462
Total State taxes paid by mine and its employees	1,268,067	3,092,299	5,407,100

Table C7--North Dakota: Estimated annual net revenue to State government from taxes attributable to model mines and their employees, 1976

Source of revenue	Size of mine (million tons per year)		
	2	5	9.2
	Dollars		
Total State taxes paid by mine and its employees	1,268,067	3,092,299	5,407,100
Apportionments:			
State aid to local governments	119,963	281,439	444,078
Coal impact development fund	364,000	910,000	1,674,400
Coal trust fund	312,000	780,000	1,435,200
Total amount for State aid and earmarked funds	795,963	1,971,439	3,553,678
Net amount to State general fund and other operating funds	472,104	1,120,860	1,853,422

Table C8--North Dakota: Estimated annual revenues of school districts attributable to model mines and their employees, 1976

Source of revenue	Size of mine (million tons per year)		
	2	5	9.2
		Dollars	
Taxes paid by mine			
Property taxes on land and structures	7,097	7,796	15,152
Taxes paid by mine employees			
Property taxes:			
Mobile homes	409	905	1,227
Owned homes	9,112	20,149	27,336
Rental housing	1,855	4,103	5,566
Total taxes paid by employees	11,376	25,157	34,129
Total school taxes paid by mine and its employees	18,473	32,953	49,281
Apportionments from State funds			
State tuition fund	4,378	9,680	13,133
School foundation program	52,459	117,811	158,877
State transportation aid	2,019	4,464	6,056
Total apportionments from State funds	58,856	131,955	178,066
Total school district revenues attributable to mine and employees	77,329	164,908	227,347

Table C9--North Dakota: Estimated annual revenues of county governments attributable to model mines and their employees, 1976

Source of revenue	Size of mine (million tons per year)		
	2	5	9.2
		Dollars	
Taxes paid by the mine			
Property taxes on land and structures	3,053	3,353	6,517
Taxes paid by mine employees			
Property taxes:			
Mobile homes	176	389	528
Owned homes	3,919	8,666	11,758
Rental housing	798	1,765	2,394
Total county taxes paid by employees	4,893	10,820	14,680
Total county taxes paid by the the mine and its employees	7,946	14,173	21,197
Apportionments from State funds			
Personal property tax replacement revenue	1,135	2,025	3,028
Highway tax distribution fund	4,803	10,619	14,408
Severance tax rebate	52,000	130,000	239,200
Total apportionments from State funds	57,938	142,644	256,636
Total county revenue attributable to mine and its employees	65,884	156,817	277,833

Table C10--North Dakota: Estimated revenues of city governments attributable to model mines and their employees, 1976

Source of revenue	Size of mine (million tons per year)		
	2	5	9.2
	Dollars		
Taxes paid by the mine			
Property taxes on land and structures	0	0	0
Taxes paid by mine employees			
Property taxes:			
Mobile homes	251	554	752
Owned homes	5,585	12,350	16,755
Rental housing	1,137	2,514	3,411
Total city taxes paid by employees	6,973	15,418	20,918
Total city taxes paid by the mine and its employees	6,973	15,418	20,918
Apportionments from State funds			
Personal property tax replacement revenue	996	2,203	2,988
City share of cigarette tax	800	1,768	2,399
Highway tax distribution fund	1,776	3,928	5,329
Total apportionments from State funds	3,572	7,899	10,716
Total city revenues attributable to mine and its employees	10,545	23,317	31,634

Table C11--North Dakota: Estimated annual revenues of township governments attributable to model mines and their employees, 1976

Source of revenue	Size of mine (million tons per year)		
	2	5	9.2
	Dollars		
Taxes paid by mine			
Property taxes on land and structures	1,068	1,174	2,281
Taxes paid by mine employees			
Property taxes:			
Mobile homes	62	136	185
Owned homes	1,372	3,033	4,115
Rental housing	279	618	838
Total township taxes paid by employees	1,713	3,787	5,138
Total township taxes paid by the mine employees	2,781	4,961	7,419
Apportionments from State funds			
Personal property tax replacement revenue	397	709	1,060
Total township revenues attributable to mine and its employees	3,178	5,670	8,479

Table C12--South Dakota: Estimated annual State tax payments by model mines and their employees, 1976

Type of tax	Size of mine (million tons per year)		
	2	5	9.2
		Dollars	
Taxes paid by mine			
Sales tax:			
Equipment	4,400	10,136	23,391
Supplies	56,085	161,878	224,830
Net production tax	122,882	205,410	293,309
Unemployment insurance	8,051	18,031	24,154
Total State taxes paid by mine	191,418	395,455	565,684
Taxes paid mine employees			
Sales tax	20,780	43,668	52,099
Motor fuels tax	7,741	17,118	23,224
Automobile registration	3,235	7,154	9,706
Cigarette tax	2,652	5,864	7,955
Alcohol excise tax	1,896	4,193	5,689
Automobile excise tax	2,423	5,359	7,270
Total State taxes paid by mine employees	38,727	83,356	105,943
Total State taxes paid by mine and its employees	230,145	478,811	671,627

Table C13--South Dakota: Estimated annual net revenue to State government attributable to model mines and their employees, 1976

Source of revenue	Size of mine (million tons per year)		
	2	5	9.2
	Dollars		
Total State taxes paid by mine and its employees	230,145	478,811	671,627
State aid to local government	1/ (2,888)	8,570	31,935
Net amount to State government	233,033	470,241	639,692

1/ Increased property values attributable to the mine and its employees would produce a reduction in the total amount of State school aid paid by the State.

Table C14--South Dakota: Estimated annual revenues of school districts attributable to model mines and their employees, 1976

Source of revenue	Size of mine (million tons per year)		
	2	5	9.2
	Dollars		
Taxes paid by mine			
Property taxes:			
Land	835	754	754
Equipment and structures	53,898	139,028	240,813
Total school taxes paid by mine	54,733	139,782	241,567
Taxes paid by mine employees			
Property taxes:			
Mobile homes	376	832	1,129
Owned homes	9,918	21,932	29,755
Rental housing	2,305	5,097	6,915
Personal property	1,437	3,179	4,312
Total school taxes paid by mine employees	14,036	31,040	42,111
Apportionments from State funds			
State general support aid	6,243	13,804	18,728
State permanent school fund	2,832	6,262	8,496
State foundation program	1/ (15,500)	1/ (19,806)	1/ (7,918)
Total apportionments from State funds	1/ (6,425)	260	19,306
Total school district revenues attributable to mine and employees	62,344	171,082	302,984

1/ Increased property values attributable to the mine and its employees would result in a reduction in the total amount of State foundation aid made available to the district.

Table C15--South Dakota: Estimated annual revenues of county governments attributable to model mines and their employees, 1976

Source of revenue	Size of mine (million tons per year)		
	2	5	9.2
	Dollars		
Taxes paid by mine			
Property taxes:			
Land	397	358	358
Equipment and structures	25,624	66,096	114,486
Total county taxes to be paid by mine	26,021	66,454	114,844
Taxes paid by mine employees			
Property taxes:			
Mobile homes	179	396	537
Owned homes	4,715	10,427	14,146
Rental housing	1,096	2,423	3,287
Personal property	683	1,511	2,050
Total county taxes to be paid by mine employees	6,673	14,757	20,020
Apportionments from State funds			
Highway and bridge fund	1,803	4,477	7,430
Low point beer tax rebate	73	162	220
County poor relief	83	184	250
Total apportionments from State funds	1,959	4,823	7,900
Total county revenue attributable to mine and its employees	34,653	86,034	142,764

Table C16--South Dakota: Estimated annual revenues of city governments attributable to model mines and their employees, 1976

Source of revenue	Size of mine (million tons per year)		
	2	5	9.2
	Dollars		
Taxes paid by the mine			
Property taxes	0	0	0
Taxes paid by mine employees:			
Property taxes:			
Mobile homes	112	249	337
Owned homes	2,964	6,554	8,892
Rental housing	689	1,523	2,066
Personal property	430	950	1,289
Total city taxes paid by employees	4,195	9,276	12,584
Total city taxes paid by mine and its employees	4,195	9,276	12,584
Apportionments from State funds			
Low point beer tax rebate	24	54	73
Alcohol tax rebate	1,553	3,433	4,655
Total apportionments from State funds	1,577	3,487	4,728
Total city revenues attributable to mine and its employees	5,772	12,763	17,312

Table C17--Wyoming: Estimated annual State tax payments by model mines and their employees, 1976

Type of tax	Size of mine (million tons per year)		
	2	5	9.2
	Dollars		
Taxes paid by mine			
Property taxes:			
Equipment and structures	6,726	12,232	14,782
Gross proceeds of mines	30,675	71,107	102,927
Total property taxes	37,401	83,339	117,709
Sales tax:			
Equipment	4,400	10,136	23,391
Supplies	40,964	118,874	162,775
Severance tax	459,544	1,065,276	1,541,977
Coal excise tax	137,863	319,584	462,593
Unemployment tax	10,407	23,306	31,222
Total State taxes paid by mine	690,579	1,620,515	2,339,667
Taxes paid by mine employees			
Property taxes:			
Mobile homes	37	84	112
Owned homes	474	1,062	1,422
Rental housing	76	170	228
Total property taxes	587	1,316	1,762
Sales tax	12,769	27,613	33,579
Cigarette tax	2,430	5,442	7,290
Alcohol excise tax	554	1,240	1,661
Liquor store profits	1,135	2,541	3,404
Motor fuel tax	7,242	16,218	21,726
Motor vehicle registration	985	2,206	2,955
Total State taxes paid by mine employees	25,702	56,576	72,377
Total State taxes paid by mine and its employees	716,281	1,677,091	2,412,044

Table C18--Wyoming: Estimated annual net revenue to State government attributable to model mines and their employees, 1976

Source of revenue	Size of mine (million tons per year)		
	2	5	9.2
	Dollars		
Total State taxes paid by mine and its employees	716,281	1,677,090	2,412,044
Apportionments:			
State and local government	48,395	114,808	160,002
Resource trust fund	1,650	3,801	8,772
State coal tax revenue account	137,863	319,583	462,593
Total amount for State aid and earmarked funds	187,908	438,192	631,367
Net amount to State general fund and other operating funds	528,373	1,238,898	1,780,677

Table C19--Wyoming: Estimated annual revenue of school districts attributable to model mines and their employees, 1976

Source of revenue	Size of mine (million tons per year)		
	2	5	9.2
		Dollars	
Taxes paid by mine			
Property taxes:			
Equipment and structures	81,573	148,343	179,269
Gross proceeds of mine	372,001	862,341	1,248,230
Total property taxes paid by the mine	453,574	1,010,684	1,427,499
Taxes paid by mine employees			
Property taxes:			
Mobile homes	454	1,017	1,363
Owned homes	5,750	12,877	17,251
Rental housing	921	2,063	2,763
Motor vehicles	4,150	9,294	12,451
Total taxes paid by mine employees	11,275	25,251	33,828
Total school taxes paid by mine and its employees	464,849	1,035,935	1,461,327
Apportionments from State funds			
School foundation program	0	0	0
Land income fund	6,765	15,263	20,460
Total apportionments from State funds	6,765	15,263	20,460
Total school district revenues attributable to mine and employees	471,614	1,051,198	1,481,787

Table C20--Wyoming: Estimated annual revenue of county governments attributable to model mines and their employees, 1976

Source of revenue	Size of mine (million tons per year)		
	2	5	9.2
	Dollars		
Taxes paid by the mine			
Property taxes:			
Equipment and structures	28,619	52,044	62,894
Gross proceeds of mines	130,510	302,538	437,921
Total property taxes paid by the mine	159,129	354,582	500,815
Taxes paid by mine employees			
Property taxes:			
Mobile homes	159	357	478
Owned homes	2,017	4,518	6,052
Rental housing	323	724	969
Motor vehicles	1,456	3,261	4,368
Total county taxes paid by employees	3,955	8,860	11,867
Total county taxes paid by mine and its employees	163,084	363,442	512,682
Apportionments from State funds			
Highway aid	26,310	58,632	82,710
Cigarette tax rebate	75	168	225
Sales and use tax rebate	3,921	10,762	15,061
Total apportionments from State funds	30,306	69,562	97,996
Total county revenue attributable to the mine and its employees	193,390	433,004	610,678

Table C21--Wyoming: Estimated annual revenue of city governments attributable to model mines and their employees, 1976

Source of revenue	Size of mine (million tons per year)		
	2	5	9.2
		Dollars	
Taxes paid by the mine			
Property taxes	0	0	0
Taxes paid by mine employees			
Property taxes:			
Mobile homes	105	236	316
Owned homes	1,332	2,983	3,996
Rental housing	213	478	640
Motor vehicles	961	2,153	2,884
Total city taxes paid by mine employees	2,611	5,850	7,836
Total city taxes paid by mine and its employees	2,611	5,850	7,836
Apportionments from State funds			
Highway aid	807	1,807	2,421
Cigarette tax rebate	1,425	3,191	4,274
Sales and use tax rebate	9,093	24,985	34,850
Total apportionments from State funds	11,325	29,983	41,545
Total city revenue attributable to the mine and its employees	13,936	35,833	49,381

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