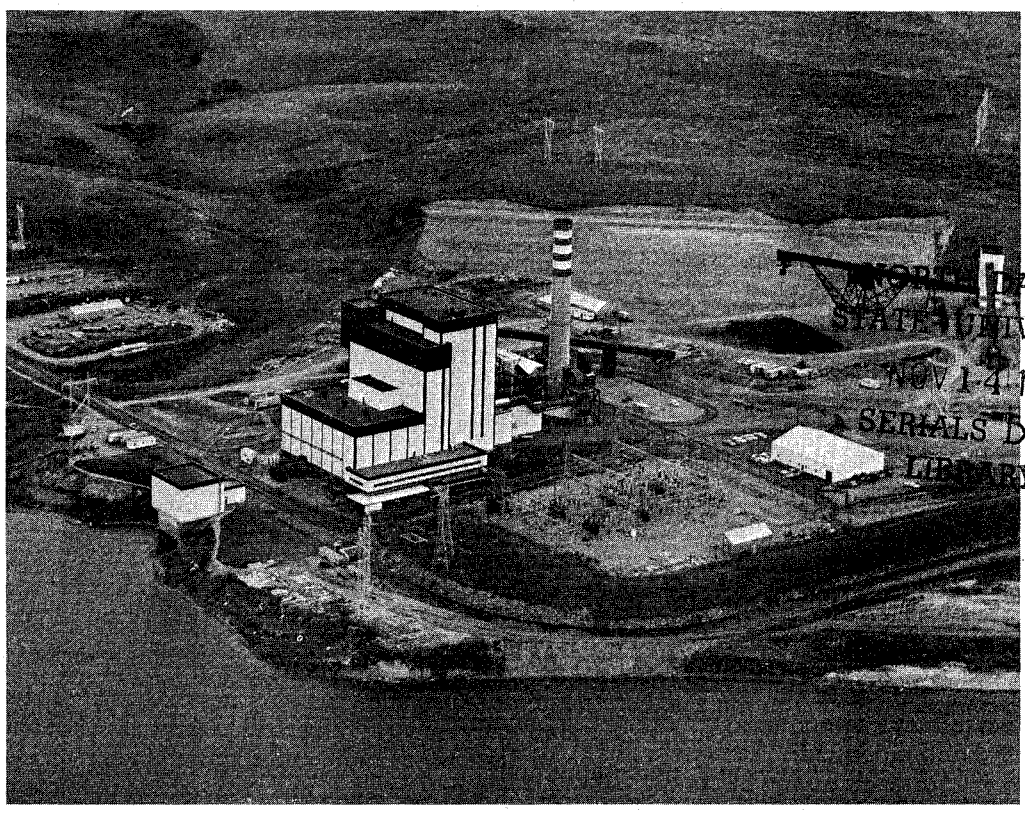
CHARACTERISTICS AND SETTLEMENT PATTERNS OF ENERGY RELATED OPERATING WORKERS IN THE NORTHERN GREAT PLAINS



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FOREWORD

This report is a continuation of research on the economic and social effects of coal development in the Northern Great Plains. The purpose of the report is to provide information on the characteristics and settlement patterns of coal mine and electric power plant operating work'forces in the Northern Great Plains. The authors express gratitude to the operating employees for completing the questionnaire and to the coal mine and electric power plant company officials for their full cooperation in this endeavor. The study would not have been possible without their cooperation and effort in completing the questionnaire.

A special acknowledgment is given Mr. James G. Thompson, Associate Director of the Center for Urban and Regional Analysis, Institute for Policy Research at the University of Wyoming, for his collaboration in designing the Wyoming survey instrument and for administering the Wyoming survey. We also wish to thank Pacific Power and Light Company for their cooperation in the Wyoming survey. Special credit must go to the staff at the Dave Johnson and Jim Bridger sites.

The research for this report was conducted under North Dakota Agricultural Experiment Station Project 3339, entitled "Water as a Parameter for Development of Energy Resources in the Upper Great Plains." The research was supported with funds from North Dakota Agricultural Experiment Station and Office of Water Resources Research and Technology, U.S. Department of the Interior.

A statistical appendix to this report, with detailed worker characteristics, is available upon request.

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Highlights

The prospect of extensive energy development in several western states has created considerable interest in potential employment opportunities, as well as possible social, economic, and environmental effects. In light of this interest, surveys were conducted during the period 1974 through 1976 to determine the socioeconomic characteristics of workers at seven coal mines and six electric generating plants in North Dakota, Montana, and Wyoming. Although characteristics of operating work forces in the future may be considerably different from present operating work forces, inferences drawn from the present work force may be useful for predicting the employee characteristics of an expanded work force. An understanding of these characteristics may be valuable in helping federal, state, and local decision makers plan for extensive development.

A total of 753 out of 1,361 employees, or 55 percent, responded to the questionniares. Of those, 95 percent were males with an average age of 35 years. The average age varied from 32 years in the Rock Springs area of Wyoming to 37 years in North Dakota. An average of almost 65 percent of the employees were local workers, varying from 82 percent in North Dakota to 47 percent in the Rock Springs area. Local workers were classified as employees who did not change their location of residence to work at their present job. The education levels of employees varied substantially with 94 percent of the workers at Glenrock having a high school degree, while only 69 percent of the workers in North Dakota had a high school diploma. An average of almost 55 percent of the employees owned their own house, varying from 69 percent at Glenrock to 37 percent in Rock Springs. This variation could be expected, as the Jim Bridger plant and mine are relatively new operations compared to the sites at Glenrock and in North Dakota. Of the North Dakota employees, 86 percent were born in North Dakota. This is in sharp contrast to the Rock Springs area where only 24 percent were born in Wyoming.

The coal industry employees had been employed an average of 65 months or over five years with their present employer. Length of employment with the present employer varied from 104 months for the North Dakota employees to 21 months for the Rock Springs employees. Again, this may be a reflection of the newness of the Rock Springs area projects.

The average distance commuted (one way) to work varied from 36 miles at Rock Springs to nine miles in North Dakota. The local workers commuted farther to work than the nonlocal workers in every area (36 miles for the locals to 35 miles for the nonlocals at Rock Springs, 22 miles to 14 miles at Glenrock, and 22 miles to 21 miles at Decker) except North Dakota where local workers commuted eight miles and nonlocal workers, 14 miles.

The annual earnings of the employees from the different areas were not comparable as the surveys were conducted at different times. The average annual wage of the North Dakota employees was approximately $12,000 in 1974. The Rock Springs and Glenrock employees earned an average annual wage of slightly more than $15,200 in 1976, and the Decker employees earned, on the average, about $16,000 in 1975. A large percentage of the employees from each area had worked in their present state just prior to their present employment. The percentage varied from 80 percent in North Dakota to 65 percent at Rock Springs.

The second objective of the study was to determine key factors influencing the number of workers that are hired locally and to develop a model to predict the local hire rate. The key factors identified and used in the model were: population, distance from the community to the project, wage levels, number of employees at a project, number of employees at other projects in the area, and the total population of the area. Regression models were used to fit the data from the four local areas and the data were also combined for a regional model. Population, distance, and employment of the project played an important role in most of the equations. While these three variables seem most important in determining the number of local workers supplied by a community to a project, the remaining variables should not be overlooked in a regional labor supply model. The regional model accounted for 44.3 percent of the variation in predicting local hiring. While much of the variance in the local hire model was unexplained, these variables represented a start in predicting the supply of local workers to major operating sites.

A third objective was to determine key factors influencing the residential choice of the nonlocal workers and to develop a model to predict settlement patterns of the nonlocal workers. Population, distance of a city to the project, and distance of a city to the regional trade center were found to be indicators of a community's attraction for nonlocal workers. The magnitude of parameters of the nonlocal models varied considerably from area to area. This would indicate that area-specific characteristcs, such as availability of housing and community services, should be taken into account in predicting residential patterns of nonlocal workers.

CHARACTERISTICS AND SETTLEMENT PATTERNS OF ENERGY RELATED OPERATING WORKERS IN THE NORTHERN GREAT PLAINS

by
James S. Wieland, F. Larry Leistritz, and Steven H. Murdock*

As concern over the supply of energy resources in the United States grows, the lignite and subbituminous coal reserves of the Fort Union Formation (which includes western North Dakota, eastern Montana, northwestern South Dakota, and northeastern Wyoming) are expected to provide an increasing portion of the energy needed to meet growing national requirements.

The Fort Union reserves account for 40 percent of the coal reserves in the United States.[1] These Fort Union reserves have been estimated to be 1.3 trillion tons.[2] Based on 1974 price and technology factors, more than 80 billion tons of these reserves are economically strippable.[3]

Future development plans for Fort Union coal call for massive increases in mine-mouth generation of electric power, coal gasification, and liquefaction to meet demands for electricity, natural gas, and other fuels. These proposals have caused concern among the area's residents and decision makers. One immediate effect of energy development is an increase in job opportunities. Rural areas, where the development will take place, have experienced a lack of employment opportunities that has led to high

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[1]Bureau of Mines, Strippable Reserves of Bituminous Coal and Lignite in the United States, Information Circular 8531, Bureau of Mines, U.S. Department of the Interior, Washington, D.C., 1971.

[2]Brant, R. A., Lignite Resources of North Dakota, U.S. Geological Survey Circular 226, 1953.

[3]U.S. Department of the Interior, Project Independence, Final Coal Task Force Report, in Project Independence Blueprint, Federal Energy Administration, Washington, D.C., November, 1974.

levels of underemployment, unemployment, and out-migration.[4] Expansion of the coal industry in these areas may slow the process of out-migration by providing employment opportunities for youth and by providing full employment for local workers who are now underemployed.

Large-scale expansion of the area's coal industry will involve not only local workers who are underemployed or would otherwise migrate out of the area, but also an influx of large numbers of people from outside the area into the area's small rural communities. Population of some of these communities could double or triple in a few years. This rapid growth will require careful planning and accurate estimates of both the direct and indirect effects of the proposed development.

Planners must translate the employment changes into requirements for services for the local communities. This will require estimates of the number of workers available from the local communities so that projections of the number of nonlocal workers can be made. Information on the workers' characteristics, commuting, and residential patterns will also be required to make accurate impact projections. These projections are required to minimize adverse impacts and maximize beneficial impacts.

Past studies provide an indication of the potential magnitude of direct and indirect effects of coal development, and also indicate the need for more information on local hiring and commuting patterns. Leholm, et al., reviewed the current socioeconomic characteristics of Mercer County and the surrounding area and estimated the possible levels of coal development the area might experience under three development scenarios.[5] As part of this study, a survey of North Dakota's coal industry provided a profile of the current operating work force in North Dakota's coal mines and electrical power generation plants. In addition, a survey of the labor force and other general characteristics of the Mercer County population was conducted by mail questionnaire and personal interview in an effort to determine the skills and availability of the local labor force that could be employed

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[4]Voelker, Stanley W., and Thomas K. Ostenson, Population Changes Within Census County Divisions of North Dakota, Agricultural Economics Report No. 75, Department of Agricultural Economics, North Dakota State University, Fargo, March, 1971.

[5]Leholm, Arlen G., F. Larry Leistritz, and Thor A. Hertsgaard, Local Impacts of Energy Resources Development in the Northern Great Plains, Northern Great Plains Resources Program, Department of Agricultural Economics, North Dakota State University, Fargo, September, 1974.

directly or indirectly in coal-related development projects. Leholm's study indicated that two critical parameters for estimating the impact of coal development had not received sufficient attention: 1) the number of local workers that would be hired, and 2) the settlement patterns of nonlocal workers (in-migrants).

Dobbs and Kiner addressed the question of local versus nonlocal hiring in their study of the Wyoming uranium industry.[6] They found that about 50 percent of the work force were from the local area and 24 percent of the uranium work force came from elsewhere within the state. Most of the local workers were recruited through company advertising and through informal channels, such as word of mouth.

Leholm, et al., in 1975 identified the socioeconomic characteristics of workers at two electric power plant construction sites in North Dakota.[7] They found that about 50 percent of the construction work force were local workers.

Mountain West Research was contracted in 1975 by the Old West Regional Commission to study the socioeconomic consequences of the construction of large energy-related facilities.[8] Workers were surveyed at 14 construction sites in eight western states. A total of 3,168 responses was obtained which reported workers' characteristics with respect to household composition, place of residence, previous residence, and occupation. Models were developed to estimate the local hiring rate and to predict the residential patterns of the nonlocal workers.

Much of the past work on local hiring rates and settlement patterns has focused on construction workers. This report analyzes the characteristics, local hiring rate, and settlement patterns of the operating work forces of energy-related facilities.

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[6]Dobbs, Thomas, and Phil Kiner, Profile of a Rural Area Work Force: The Wyoming Uranium Industry, Agricultural Experiment Station, Research Journal 79, University of Wyoming, Laramie, January, 1974, p. 28.

[7]Leholm, Arlen G., F. Larry Leistritz, and James S. Wieland, Profile of Electric Power Plant Construction Work Force, Agricultural Economics Statistical Series Issue No. 22, Department of Agricultural Economics, North Dakota State University, Fargo, July, 1976.

[8]Mountain West Research, Inc., Construction Worker Profile Final Report, a study for the Old West Regional Commission, December, 1975.

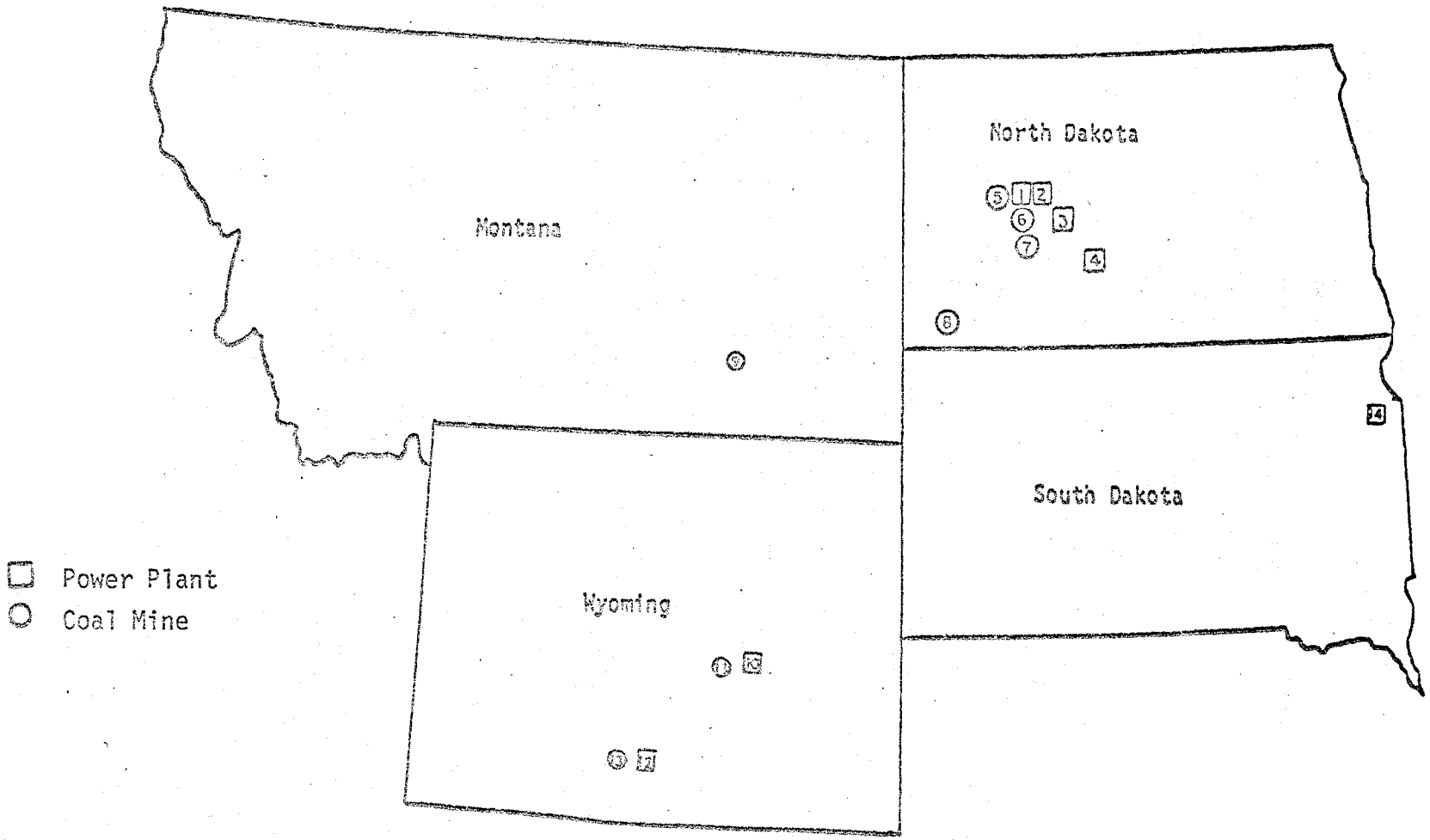
The objectives of this study were:

1. To identify socioeconomic characteristics of operating work forces at electric generating plants and coal mines in North Dakota, South Dakota, Montana, and Wyoming.
2. To determine those factors that have the greatest influence on the number of workers that are hired locally and to develop a model to predict the local hire rate.
3. To determine those factors that most influence the residential choices of nonlocal workers and to develop a model to predict the settlement patterns of nonlocal workers.

Study Area

The study area consisted of coal mines and electric generating power plants in North Dakota, South Dakota, Montana, and Wyoming (Figure 1). The study area was segregated in order to examine differences in worker characteristics among four regions: 1) employees at the four coal mines and four electric generating power plants located in western North Dakota; 2) employees at the Jim Bridger Power Plant and associated mine located near Rock Springs, Wyoming; 3) employees at the Dave Johnson Power Plant and associated coal mine located near Glenrock, Wyoming; and 4) employees at the Decker Mine located in southeastern Montana. Sufficient data were not available from the Big Stone Power Plant located in northeastern South Dakota to comprise another region. However, data from employers at the Big Stone Plant were used to test the residential prediction model described in this study.

The data collected for use in this analysis were obtained during the summers of 1974, 1975, and 1976. A survey was conducted of North Dakota's power plant and coal mine employees in 1974 (Appendix A). Questionnaires were distributed at Otter Tail Power Company's Big Stone Power Plant in South Dakota in the summer of 1975 (Appendix B). Data from the Decker Mine near Decker, Montana, were made available by the Decker Coal Company in 1975. The employees of the Dave Johnson and Jim Bridger power plants and associated mines were surveyed in the summer of 1976 (Appendix C). A summary of the power plants and coal mines at which employees were surveyed, the year they were surveyed, number of employees, and response rates are included in Table 1.



1. UPA Stanton Power Plant
2. Leland Olds Power Plant
3. Milton R. Young Power Plant
4. R. M. Heskett Power Plant
5. Indianhead Mine
6. Glenharold Mine
7. Knife River - Beulah Mine
8. Knife River - Gascoyne Mine
9. Decker Mine
10. Dave Johnson Power Plant
11. Dave Johnson Mine
12. Jim Bridger Power Plant
13. Jim Bridger Mine
14. Big Stone Power Plant

Figure 1. Power Plants and Coal Mines at Which Employees Were Surveyed.

TABLE 1. SUMMARY OF POWER PLANTS AND COAL MINES AT WHICH EMPLOYEES WERE SURVEYED, YEAR SURVEYED, NUMBER OF EMPLOYEES, AND RESPONSE RATE, 1974-1976

State and Site Surveyed	Year Collected	Number of Employees	Number of Responses	Percent Response
North Dakota				
R. M. Heskett Plant (Montana Dakota Utilities)	1974	45	20	44.4
Leland Olds Plant (Basin Electric Co-op)	1974	47	31	66.0
Stanton Plant (United Power Cooperative)	1974	53	24	45.3
Milton R. Young Plant (Minnkota Power Co-op)	1974	42	16	38.1
Beulah Mine (Knife River Coal Co.)	1974	69	69	100.0
Gascoyne Mine (Knife River Coal Co.)	1974	37	37	100.0
Glenharold Mine (Consolidation Coal Co.)	1974	73	14	19.2
Indianhead Mine (North American Coal Co.)	1974	50	30	60.0
Subtotal		416	241	57.9
South Dakota				
Big Stone Plant (Otter Tail Power Company)	1975	45	43	95.6
Montana				
Decker Mine (Peter Kiewit Sons, Inc.)	1975	280	116	41.4
Wyoming				
Jim Bridger Plant (Pacific Power and Light Co.)	1976	180	91	50.6
Jim Bridger Mine (Pacific Power and Light Co.)	1976	160	150	93.8
Dave Johnson Plant (Pacific Power and Light Co.)	1976	179	108	60.3
Dave Johnson Mine (Pacific Power and Light Co.)	1976	146	47	32.2
Subtotal		665	396	59.5
Total		1,406	796	56.6

History of Coal Mining and Power Production

North Dakota

North Dakota has experienced coal mining since the turn of the century. However, until ten years ago, most coal mined was used to fuel homes, businesses, and small power plants in the area. The R. M. Heskett Plant located near Mandan was in operation through the 1950's, and in 1963 the power plant was increased from 25 to 100 megawatts. Knife River's Beulah Mine, which fuels the R. M. Heskett Plant, has been in operation for many years. This mine also fuels a small 13 megawatt power plant in Beulah and a power plant owned by Otter Tail Power Company in Fergus Falls, Minnesota.

Construction was completed on Basin Electric's Leland Olds No. 1 Power Plant located near Stanton in 1966. This is a 212 megawatt electric generating plant. Consolidation Coal Company's Glenharold Mine was expanded at that time to fuel the power plant. Glenharold's coal production has been increased recently with completion of the Leland Olds No. II Plant (460 megawatts).

United Power Association's Stanton Plant began operation in 1967. This power plant has a capacity of 172 megawatts. North American Coal Corporations' Indianhead Mine fuels this power plant by shipment of its coal by rail to the plant.

Minnkota Power Cooperative's Milton R. Young Plant is a 235 megawatt facility that became operational in late 1970. The Knife River Coal Company has an export mine located near Gascoyne. This mine was expanded in 1975 to fuel Otter Tail's Big Stone Power Plant located in South Dakota. Production figures for 1976 for the North Dakota coal mines included in the surveys are shown in Table 2.

Rock Springs, Wyoming

Sweetwater County, the location of the Jim Bridger Plant and Mine, has some of the most abundant mineral resources in the state, containing much of the state's natural gas, oil, and trona production. Coal production was minimal in the area until 1973 when production rose sharply to fuel the Jim Bridger Power Plant. Total 1976 production of the Jim Bridger Mine was over 3,500,000 tons. Construction on the $1 billion Jim Bridger project began in late summer of 1970. The project consists of four 500 megawatt units with the last unit to be completed in 1979. The first unit became

operational in 1974. The plant and mine are located 35 miles northeast of Rock Springs in a sparsely populated area commonly referred to as the "Red Desert Basin." Coal production is expected to increase rapidly as eight mines are expected to begin production by the early 1980's.

TABLE 2. ANNUAL PRODUCTION OF COAL MINES SURVEYED IN NORTH DAKOTA, 1976[a]

Mine Name	1976 Production (tons)
Knife River Beulah Mine	836,919
Glenharold Mine	3,285,306
Indianhead Mine	1,065,021
Knife River Gascoyne Mine	2,611,338
Total Production	7,799,420

[a]Coal production is based on the fiscal year which ended June 30, 1976.

SOURCE: Annual reports of Coal Production by Safety Division, Workmens Compensation Division, 1976.

Glenrock, Wyoming

The Dave Johnson Power Plant and associated mine is located in Converse County, near Glenrock, Wyoming. Converse County is rich in minerals with large deposits of oil, natural gas, uranium, and coal. The only coal presently mined in the county is about three million tons produced by the Dave Johnson Mine as fuel for the Dave Johnson Plant.

The Dave Johnson Plant consists of four electric generating units with a total generating capacity of 750 megawatts. Construction began on Unit 1 (a 100 megawatt facility) in 1956, with operation beginning in November of 1958. Unit 2, also a 100 megawatt facility, was completed in January, 1961. Unit 3, a 220 megawatt facility, became operational in the summer of 1964 and the 330 megawatt facility, unit 4, began operation in June, 1972. Casper, Wyoming, a community of almost 60,000 people, is located approximately 30 miles from both the mine and the plant.

Decker, Montana

The Decker Coal Mine is located in the southeastern part of Big Horn County, Montana, in a sparsely populated area of the state. Sheridan,

Wyoming, with a population of 10,900 in 1970, is located 23 miles south of the mine and is the only community with a population over 300 within 40 miles of the site. The mine, which produces more coal than any other surface mine in the United States, started production in the early 1970's. Total 1976 production was more than 10 million tons. Current plans call for production to increase rapidly in the next few years. Coal is currently being exported to various sites throughout the United States.

General Socioeconomic Characteristics

Surveys of coal industry employees were conducted during 1974, 1975, and 1976, to obtain work force characteristics. Although characteristics of operating work forces in the future may be considerably different from present operating work forces, inferences drawn from the present work force may be useful for predicting employee characteristics of an expanded work force.

A total of 753 employees responded to the questionnaires (Table 3).[9] Of those, 94.6 percent were males with an average age of 34.7 years. Almost 65 percent of the employees were local workers. A local worker was classified as an employee who did not change his location of residence to work at his present job. Almost 83 percent of the employees were married. The employees had an average of 1.57 children per worker and 54.5 percent of the employees owned a house. The workers had lived an average of 168 months or 14 years at their present address. Almost 53 percent of the employees were born in the state in which they are now working.

The number of local workers hired at each site varied from 82.2 percent in North Dakota to 46.9 percent in Rock Springs (Table 3). The educational levels of employees varied substantially with 93.5 percent of the workers at Glenrock having a high school degree, while only 69.3 percent of the workers in North Dakota had a high school diploma. Because of these substantial differences in worker characteristics it seems that the characteristics of workers at each site are unique and, therefore, the characteristics of workers in each area are discussed individually. Comparisons of coal mine and power plant employees' characteristics indicated there were no substantial differences.

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[9]The employees from the Big Stone Plant were not included in this summary table.

TABLE 3. A COMPARISON OF VARIOUS WORKER CHARACTERISTICS BY REGION AND EACH INDIVIDUAL AREA[a]

	North Dakota	Glenrock (Wyoming)	Rock Springs (Wyoming)	Decker (Montana)	All Employees
General Worker Characteristics:					
Total Number of Respondents	241	155	241	116	753
Percent Local Workers	82.2	60.6	46.9	69.8	64.5
Percent Males	92.9	94.2	96.7	94.0	94.6
Average Age	36.8	34.9	32.4	b	34.7
Percent High School Graduates	69.3	93.5	89.6	90.5	84.1
Percent Married	87.1	81.3	77.6	86.2	82.7
Number of Children Per Worker[c]	1.79	1.54	1.49	1.35	1.57
Percent Owning a House	67.2	69.0	36.9	44.8	54.5
Length of Residence (Months)[d]	264	150	83	b	168
Percent Born in Present State	86.3	43.9	24.1	54.3	52.7
Present Employment Characteristics:					
Months Employed	104	72	21	b	65
Number of Positions with Present Company	1.7	2.8	2.0	b	2.1
Average Distance Commuted (Miles)	9.2	18.8	35.6	21.6	21.5
Previous Employment Characteristics:					
Previous Length Employed (Months)	48	44	45	b	46
Percent Working Prior to Present Employment in Present State	79.6	74.8	65.1	b	73.0

[a]Because data were not available from the Decker Mine for certain worker characteristics, some averages were based on 637 employees.
[b]Data were not available from the Decker employees for these characteristics.
[c]This includes both married and unmarried employees.
[d]The length of residence refers to the number of months an individual has lived in his present community.

Profile of North Dakota's Operating Work Force

Forty-three of the 241 North Dakota employees who answered the operating work force questionnaire were nonlocal workers. Nonlocal workers were defined as employees who had moved into their present community within the last five years.[10] Local workers were considerably older than nonlocal workers with an average age of 38.6 years compared to 28.0 years of age, respectively. Almost 90 percent of the local and 81.4 percent of the nonlocal workers were married. Only 1 percent of the local workers and none of the nonlocal workers were widowed or divorced (Table 4). Local workers had an average of 1.86 children per worker, while nonlocal workers had 1.45 children. Married local workers had an average family size of 4.11 and nonlocal workers 3.74.

TABLE 4. MARITAL STATUS OF LOCAL AND NONLOCAL COAL INDUSTRY EMPLOYEES, NORTH DAKOTA, 1974

Marital Status	Local		Nonlocal	
	Number	Percent	Number	Percent
Married	175	88.4	35	81.4
Single	20	10.1	8	18.6
Widowed or Divorced	2	1.0	0	0.0
No Answer	1	0.5	0	0.0
TOTAL	198	100.0	43	100.0

Over 90 percent of the local workers and 65.1 percent of the nonlocal workers were born in North Dakota. Forty-six percent of the local workers and 37.2 percent of the nonlocal workers lived in a city with a population of 1,000 to 2,500 people (Table 5). Local workers had lived an average of 26.4 years in their present community and nonlocal workers 1.8 years.

Over 70 percent of the local workers and almost 40 percent of the nonlocal workers owned a single family house, while 9.6 percent of the local workers and 37.2 percent of the nonlocal workers rented housing (Table 6). Typically, the longer a worker lived in a community, the higher the probability that he would own a single family house. This is indicated in a cross-tabulation of these two variables (Appendix Table 1).

[10] This definition of local and nonlocal workers differs from that of the other work forces because the North Dakota questionnaire did not contain a question to determine if the workers had changed their residence to take their present job. However, through a combination of several questions, workers could be classified into local and nonlocal categories.

TABLE 5. CITY SIZE OF RESIDENCE OF LOCAL AND NONLOCAL COAL INDUSTRY EMPLOYEES, NORTH DAKOTA, 1974

City Size of Residence	Local		Nonlocal	
	Number	Percent	Number	Percent
Farm	28	14.1	4	9.3
Outside City Limits, But Not a Farm	11	5.6	4	9.3
City Under 500 Population	33	16.7	5	11.6
City Between 500-1,000 Population	21	10.6	6	14.0
City Between 1,000-2,500 Population	91	46.0	16	37.2
City Between 2,500-5,000 Population	2	1.0	2	4.7
City Between 5,000-10,000 Population	0	0.0	0	0.0
City Over 10,000 Population	11	5.6	5	11.6
No Answer	1	0.5	1	2.3
TOTAL	198	100.0	43	100.0

TABLE 6. PRESENT HOUSING OF LOCAL AND NONLOCAL COAL INDUSTRY EMPLOYEES, NORTH DAKOTA, 1974

Present Housing	Local		Nonlocal	
	Number	Percent	Number	Percent
Own House	140	70.7	17	39.5
Own Mobile Home	27	13.6	7	16.3
Own Other[a]	3	1.5	3	7.0
Rent Apartment	4	2.0	7	16.3
Rent House	14	7.1	7	16.3
Rent Mobile Home	1	0.5	1	2.3
Rent Other	0	0.0	1	2.3
No Answer	9	4.5	0	0.0
TOTAL	198	100.0	43	100.0

[a]"Own other" category includes condominiums, duplexes, and fourplexes.

Over 60 percent of the nonlocal workers had formal education beyond high school compared to less than 20 percent of the local workers. Almost 30 percent of the local and 37.2 percent of the nonlocal workers had received some vocational training. Almost 13 percent of the local and 16.3 percent of the nonlocal workers had received over 12 months of vocational training (Table 7). The types of vocational training most frequently reported were in the area of electrical, mechanical, and welding skills.

TABLE 7. EDUCATIONAL CHARACTERISTICS OF LOCAL AND NONLOCAL COAL INDUSTRY EMPLOYEES, NORTH DAKOTA, 1974

Educational Characteristics	Local		Nonlocal	
	Number	Percent	Number	Percent
Years of Formal Education:[a]				
8 Years or Less	51	25.8	1	2.3
9-11 Years	19	9.6	2	4.7
12 Years	84	42.4	14	32.6
13-15 Years	31	15.7	11	25.6
16 or More Years	8	4.0	15	34.9
No Answer	5	2.5	0	0.0
TOTAL	198	100.0	43	100.0
Months of Vocational Training:[b]				
6 Months or Less	14	7.1	2	4.7
7-12 Months	14	7.1	5	11.6
13-18 Months	7	3.5	4	9.3
19-24 Months	8	4.0	0	0.0
25 or More Months	11	5.6	3	7.0
Time Unknown	5	2.5	2	4.7
No Vocational Training	102	51.5	17	39.5
No Answer	37	18.7	10	23.3
TOTAL	198	100.0	43	100.0

[a]Excludes vocational training beyond high school.
[b]Vocational training does not include on-the-job training.

The most frequent previous occupations of local employees consisted of general laborers (37.3 percent) and equipment operators (23.6 percent) (Table 8). More than 27 percent of the nonlocal employees had previously been employed as office or management personnel; while 24.2 percent of the nonlocal workers had been mechanics, welders, and carpenters. In general, data on previous and present occupations indicate a strong relationship between the operating workers' previous and present employment.

Of special interest is the fact that over 28 percent of the local employees and 9.8 percent of the nonlocal employees worked in the construction industry prior to their present employment. This finding would seem to indicate that individuals with construction backgrounds are likely to seek mine and power plant employment (Table 9). In addition these workers appear to be highly mobile with over 83 percent of the local and 75.6 percent of the nonlocal employees having worked for more than one employer.

TABLE 8. PREVIOUS JOB CLASSIFICATION OF LOCAL AND NONLOCAL COAL INDUSTRY EMPLOYEES, NORTH DAKOTA, 1974[a]

Job Classification	Local		Nonlocal	
	Number	Percent	Number	Percent
General Laborers	60	37.3	4	12.1
Electricians and Engineers	6	3.7	6	18.2
Office and Management Personnel	20	12.4	9	27.3
Mechanics, Welders, and Carpenters	25	15.5	8	24.2
Equipment Operators	38	23.6	3	9.1
Farmers	7	4.3	0	0.0
Miscellaneous	5	3.1	3	9.1
TOTAL	161	100.0	33	100.0

[a]Forty-four employees had no previous employment and three employees failed to answer the previous employment question.

TABLE 9. PREVIOUS INDUSTRY CLASSIFICATION OF LOCAL AND NONLOCAL COAL INDUSTRY EMPLOYEES, NORTH DAKOTA, 1974

Industry Classification	Local		Nonlocal	
	Number	Percent	Number	Percent
Agriculture	7	3.5	1	2.4
Mining	27	13.6	3	7.3
Construction	57	28.8	4	9.8
Manufacturing	17	8.6	8	19.5
Transportation	15	7.6	1	2.4
Wholesale and Retail Trade	20	10.1	5	12.2
Government Employment	10	5.1	4	9.8
Personal Services	6	3.0	4	9.8
No Previous Employment	34	17.2	10	24.4
No Answer	5	2.5	1	2.4
TOTAL	198	100.0	41	100.0

Over 80 percent of the local workers and 66.7 percent of the nonlocal workers earned less than $9,000 at their previous job (Table 10). Median income range of both local and nonlocal workers was $6,000 to $8,999. Local workers had been employed with their previous company for an average of 4.2 years and nonlocal workers for 3.1 years.

TABLE 10. PREVIOUS ANNUAL EARNINGS OF LOCAL AND NONLOCAL COAL INDUSTRY EMPLOYEES, NORTH DAKOTA, 1974[a]

Earnings Category	Local		Nonlocal	
	Number	Percent	Number	Percent
Less Than $6,000	71	43.3	10	30.3
$6,000-$8,999	60	36.6	12	36.4
$9,000-$10,999	15	9.1	6	18.2
$11,000-$12,999	5	3.0	1	3.0
$13,000-$14,999	3	1.8	2	6.1
$15,000-$16,999	1	0.6	0	0.0
Over $17,000	0	0.0	0	0.0
No Answer	9	5.5	2	6.1
TOTAL	164	100.0	33	100.0

[a]Forty-four employees had no previous employment.

Local operating workers had worked an average of 9.9 years and the nonlocals 3.1 years with their present company. The local workers had held an average of 1.8 jobs and the nonlocals 1.2 jobs with their present employer. Over 24 percent of the local workers and 30.2 percent of the nonlocal workers earned over $13,000 with the median category being $11,000 to $12,999 (Table 11).

TABLE 11. ANNUAL EARNINGS OF LOCAL AND NONLOCAL COAL INDUSTRY EMPLOYEES, NORTH DAKOTA, 1974

Earnings Category	Local		Nonlocal	
	Number	Percent	Number	Percent
Less Than $6,000	12	6.1	7	16.3
$6,000-$8,999	10	5.1	0	0.0
$9,000-$10,999	37	18.7	9	20.9
$11,000-$12,999	81	40.9	10	23.3
$13,000-$14,999	29	14.6	11	25.6
$15,000-$16,999	12	6.1	1	2.3
Over $17,000	7	3.5	1	2.3
No Answer	10	5.1	4	9.3
TOTAL	198	100.0	43	100.0

Over 22 percent of the local workers and 4.7 percent of the nonlocal workers were general laborers, while 27.9 percent of the nonlocal and only 4 percent of the local workers were in the electrician, engineer, and boiler attendant category (Table 12). This indicates that the skilled and semi-skilled positions tend to be filled by nonlocal workers. Most workers entered the coal industry in the same occupation that they held in their previous job.

TABLE 12. PRESENT JOB CLASSIFICATION OF LOCAL AND NONLOCAL COAL INDUSTRY EMPLOYEES, NORTH DAKOTA, 1974

Present Job Classification	Local		Nonlocal	
	Number	Percent	Number	Percent
Yard Operators or Car Spotters	13	6.6	2	4.7
Dragline or Shovel Operators and Dragline Oilers	16	8.1	0	0.0
General Laborers	44	22.2	2	4.7
Mechanics, Welders, Carpenters	24	12.1	5	11.6
Electricians, Engineers, and Boiler Attendants	8	4.0	12	27.9
Accountants and Office Personnel	9	4.5	6	14.0
Managers and Foremen	31	15.7	9	20.9
Dozer Operators and Truck Drivers	37	18.7	4	9.3
Miscellaneous	16	8.1	3	7.0
TOTAL	198	100.0	43	100.0

Seventy-two percent of the local workers and 53.5 percent of the nonlocal workers commuted less than 10 miles to work (Table 13). Local operating workers commuted an average of 8.1 miles to work daily (one way), while the nonlocal workers commuted an average of 14.4 miles. A higher percentage of the nonlocal workers commuted in car pools (34.9 percent) compared to 21.7 percent of the local workers, while 76 percent of the local and 46.5 percent of the nonlocal workers traveled to work in private vehicles.

Residential Patterns

The employees at UPA's Stanton plant, Basin's Leland Olds Plant, and Consolidation's Glenharold Mine are grouped together for discussion of residential patterns.[11] There were 50 local worker respondents at the

[11] These three sites are located within a one-mile radius of each other and approximately three miles from Stanton.

three operating sites near Stanton (Table 14). Of these respondents, 40 percent lived in Hazen and 26.0 percent in Stanton. Five of the 17 nonlocal workers lived in Hazen and Washburn, respectively, with only two residing in Stanton.

TABLE 13. DISTANCE TRAVELED TO WORK BY LOCAL AND NONLOCAL COAL INDUSTRY EMPLOYEES, NORTH DAKOTA, 1974

Distance Traveled	Local		Nonlocal	
	Number	Percent	Number	Percent
1-10 Miles	144	72.7	23	53.5
11-20 Miles	39	19.7	14	32.6
21-30 Miles	12	6.1	3	7.0
31-40 Miles	1	0.5	1	2.3
41-60 Miles	0	0.0	0	0.0
61 and Over Miles	0	0.0	1	2.3
No Answer	2	1.0	0	0.0
TOTAL	198	100.0	43	100.0

Seven of the eight local workers answering the survey at the Milton R. Young Power Plant lived in Center (Table 14). Six of the eight nonlocal workers at the site lived in Center while two lived in Mandan. Over 38 percent of the 31 local workers at Knife River's Gascoyne Mine lived in Scranton. More than 22 percent of the local workers lived on farms. There were six nonlocal workers at the mine and two each lived in Bowman, Scranton, and Gascoyne.

More than 90 percent of the 66 local employees at Knife River's Beulah Mine lived in Beulah (Table 14). Three nonlocal workers that worked at the site lived in Beulah, Hazen, and Bismarck. There were 23 local workers employed at the Indianhead Mine. Over 52 percent of those lived in Beulah and 34.8 percent in Zap. All seven of the nonlocal workers lived in Beulah.

Montana Dakota Utility's R. M. Heskett Plant had 18 local workers and two nonlocal workers, all of whom lived in Bismarck-Mandan. Since this study focuses primarily on local hiring and residential prediction in rural areas, the R. M. Heskett Power Plant, which is located two miles out of Mandan, was excluded from the data used in the models. The locations of the North Dakota coal mines and power plants discussed in this report are shown in Figure 2.

TABLE 14. PLACE OF RESIDENCE OF COAL INDUSTRY OPERATING EMPLOYEES FOR TOTAL, LOCAL, AND NONLOCAL WORKERS, NORTH DAKOTA, 1974

Residence	Miles From Site	1970 Population	Leland Old's Plant, Glenharold Mine, UPA Stanton Plant						Miles From Site	Milton R. Young Plant					
			Total		Local		Nonlocal			Total		Local		Nonlocal	
			Number	Percent	Number	Percent	Number	Percent		Number	Percent	Number	Percent	Number	Percent
Farm			6	9.0	4	2.0	2	11.8							
Hazen	14	1,240	25	37.3	20	40.0	5	29.4							
Stanton	3	517	15	22.4	13	26.0	2	11.8							
Beulah	22	1,344	8	11.9	7	14.0	1	5.9							
Underwood	33	781	2	3.0	1	2.0	1	5.9							
Washburn	21	804	8	11.9	3	6.0	5	29.4							
Center	14	619	2	3.0	1	2.0	1	5.9	4	13	81.3	7	87.5	6	75.0
Zap	30	271	1	1.5	1	2.0	0	0.0							
Mandan									34	3	18.8	1	12.5	2	25.0
TOTAL			67	100.0	50	100.0	17	100.0	16	16	100.0	8	100.0	8	100.0

Residence	Miles From Site	1970 Population	K. R. Gascoyne Mine					
			Total		Local		Nonlocal	
			Number	Percent	Number	Percent	Number	Percent
Bowman	21	1,762	3	8.1	1	3.2	2	33.3
Scranton	8	360	14	37.8	12	38.7	2	33.3
Gascoyne	3	34	6	16.2	4	12.9	2	33.3
Reeder	7	306	4	10.8	4	12.9	0	0.0
Bucyrus	17	42	2	5.4	2	6.5	0	0.0
Hettinger	25	1,655	1	2.7	1	3.2	0	0.0
No Answer								
TOTAL			37	100.0	31	100.0	6	100.0

Residence	Miles From Site	1970 Population	K. R. Beulah Mine						Miles From Site	Indianhead Mine					
			Total		Local		Nonlocal			Total		Local		Nonlocal	
			Number	Percent	Number	Percent	Number	Percent		Number	Percent	Number	Percent	Number	Percent
Farm			4	5.8	4	6.1	0	0.0							
Beulah	2	1,344	61	88.4	60	90.1	1	33.3	11	19	63.3	12	52.2	7	100.0
Hazen	11	1,240	1	1.4	0	0.0	1	33.3							
Zap	11	271	1	1.4	1	1.5	0	0.0	3	8	26.7	8	34.8	0	0.0
Dodge	20	121	1	1.4	1	1.5	0	0.0	16	1	3.3	1	4.3	0	0.0
Bismarck	75	34,703	1	1.4	0	0.0	1	33.3							
G. Valley									8	2	6.7	2	8.7	0	0.0
TOTAL			69	100.0	66	100.0	3	100.0		30	100.0	23	100.0	7	100.0

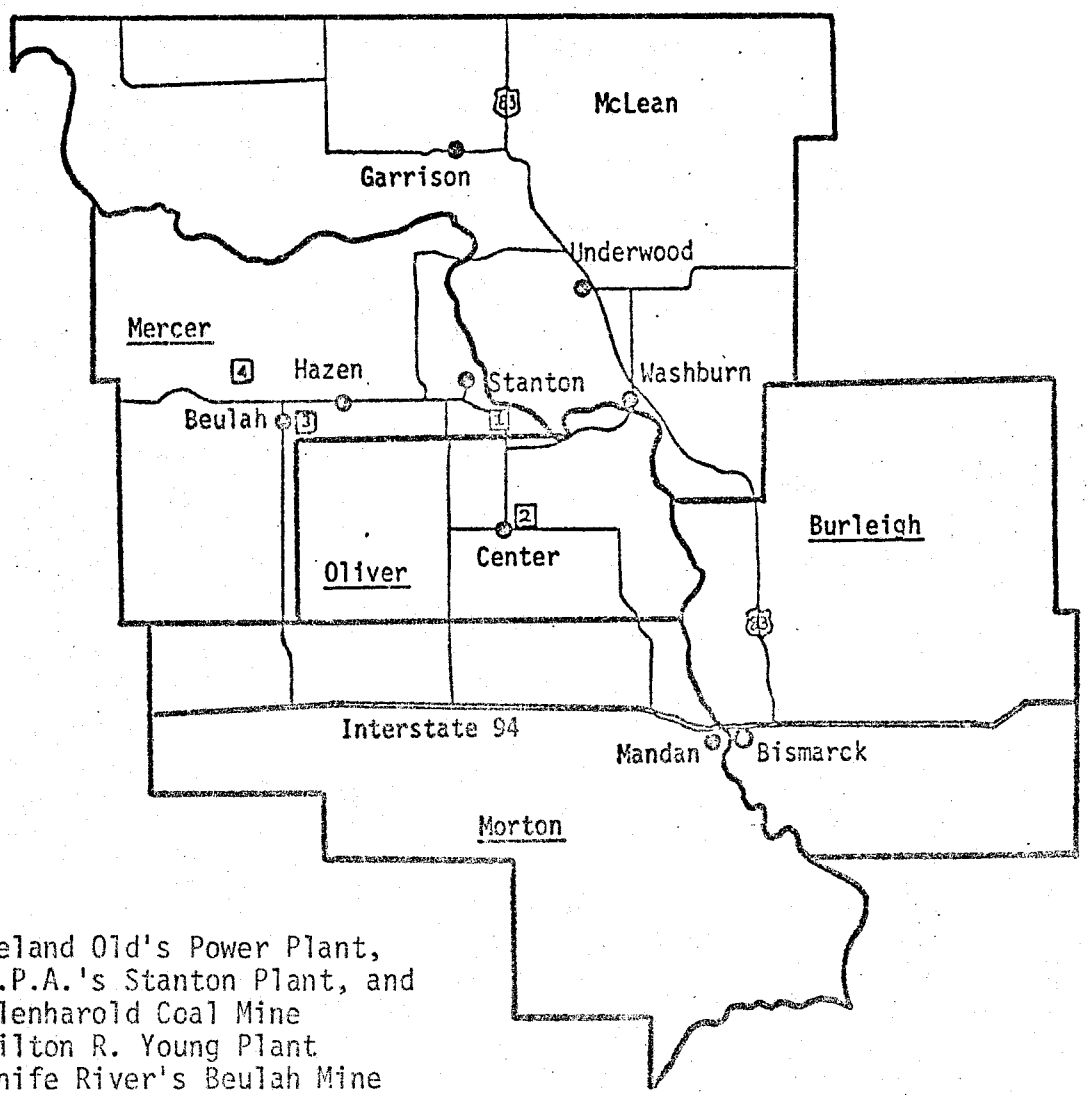

Figure 2. Location of North Dakota Power Plants and Coal Mines, 1976[a]

[a]Knife River's Gascoyne Mine is located in the southwest corner of the state and could not be included in this figure.

Profile of Rock Springs, Wyoming, Work Force

One hundred and twenty-eight, or 53.1 percent, of the 241 employees at the Jim Bridger Power Plant and Mine were nonlocal workers (Table 15). Nonlocal workers were again defined as those who changed residences to work at their present job. Local and nonlocal workers were approximately the same age; local workers averaged 32.0 years of age and nonlocal workers had an average age of 32.9 years. Seventy-seven percent of the local workers and 78.1 percent of the nonlocal workers were married. Only 1.8 percent of the local workers and 10.2 percent of the nonlocal workers were widowed or divorced.

TABLE 15. MARITAL STATUS OF LOCAL AND NONLOCAL COAL INDUSTRY EMPLOYEES, ROCK SPRINGS, WYOMING, 1976

Marital Status	Local		Nonlocal	
	Number	Percent	Number	Percent
Married	87	77.0	100	78.1
Single	23	20.4	15	11.7
Widowed or Divorced	2	1.8	13	10.2
No Answer	1	0.9	0	0.0
TOTAL	113	100.0	128	100.0

Local workers had an average of 1.37 children per worker, while nonlocal workers had 1.59 children. Almost 97 percent of the local and 98.0 percent of the nonlocal workers had their families living with them. Married local workers who had their families living with them had an average family size of 3.85 and the nonlocal workers 4.08.[12] Wyoming was the birthplace of 29.2 percent of the local workers and 19.5 percent of the nonlocal workers. An additional 28.3 percent of the local and 25.8 percent of the nonlocal workers were born in the adjoining states of Montana, South Dakota, Nebraska, Colorado, Utah, and Idaho. Over 82 percent of the local workers and 86.7 percent of the nonlocal workers lived in a community with a population of over 10,000 people (Table 16). Local workers had lived an average of 11.1 years and nonlocal workers 3.2 years in their present community.

[12]Family size consisted of married employees currently living with their families, spouses, and children.

TABLE 16. CITY SIZE OF RESIDENCE OF LOCAL AND NONLOCAL COAL INDUSTRY EMPLOYEES, ROCK SPRINGS, WYOMING, 1976

City Size of Residence	Local		Nonlocal	
	Number	Percent	Number	Percent
Farm	0	0.0	0	0.0
City Under 500 Population	16	14.2	13	10.2
City Between 500-1,000 Population	0	0.0	0	0.0
City Between 1,000-2,500 Population	0	0.0	0	0.0
City Between 2,500-5,000 Population	0	0.0	0	0.0
City Between 5,000-10,000 Population	4	3.5	4	3.1
City Over 10,000 Population	93	82.3	111	86.7
No Answer	0	0.0	0	0.0
TOTAL	113	100.0	128	100.0

Over 38 percent of the local and 35.9 percent of the nonlocal workers owned a single family house; whereas, 20.4 percent of the local and 33.6 percent of the nonlocal workers rented some form of housing (Table 17). One reason for the low percentage of workers owning single family dwellings may be the lack of available houses in the Rock Springs area.

TABLE 17. PRESENT HOUSING OF LOCAL AND NONLOCAL COAL INDUSTRY EMPLOYEES, ROCK SPRINGS, WYOMING, 1976

Present Housing	Local		Nonlocal	
	Number	Percent	Number	Percent
Own House	43	38.1	46	35.9
Own Mobile Home	32	28.3	35	27.3
Own Other[a]	2	1.8	2	1.6
Rent Apartment	10	8.8	10	7.8
Rent House	14	12.4	7	5.5
Rent Mobile Home	7	6.2	26	20.3
Rent Other	2	1.8	0	0.0
No Answer	3	2.7	2	1.6
TOTAL	113	100.0	128	100.0

[a]"Own other" category includes condominiums, duplexes, and fourplexes.

The work force in the Rock Springs area had higher levels of educational attainment with 85.9 percent of the local and 93.1 percent of the nonlocal workers having completed high school (Table 18). Nonlocal workers included a larger percent of college graduates with 10.2 percent of nonlocal workers but only 2.7 percent of local workers having obtained college degrees.

TABLE 18. YEARS OF FORMAL EDUCATION OF LOCAL AND NONLOCAL COAL INDUSTRY EMPLOYEES, ROCK SPRINGS, WYOMING, 1976

Years of Formal Education	Local		Nonlocal	
	Number	Percent	Number	Percent
8 Years or Less	2	1.8	0	0.0
9-11 Years	13	11.5	5	3.9
12 Years	52	46.0	56	43.8
13-15 Years	42	37.2	50	39.1
16 or More Years	3	2.7	13	10.2
No Answer	1	0.9	3	2.3
TOTAL	113	100.0	128	100.0

Previous job classification of local employees consisted of 24.8 percent equipment operators and 19.5 percent in each of office and management personnel, and mechanics, welders, and carpenters (Table 19). Among nonlocal workers, 25.0 percent were equipment operators and 21.1 percent office and management personnel. Only 15.0 percent of the local and 11.7 percent of the nonlocal workers had been employed as general laborers prior to their present employment. This may indicate that many workers came from other coal-related employment or construction employment where similar skills were required. This was obvious in the Rock Springs area, as many workers who had entered the area to work on the construction phase of the Jim Bridger Power Plant accepted employment in either the operating phase of the plant or the local coal mining industry.

TABLE 19. PREVIOUS JOB CLASSIFICATION OF LOCAL AND NONLOCAL COAL INDUSTRY EMPLOYEES, ROCK SPRINGS, WYOMING, 1976

Job Classifications	Local		Nonlocal	
	Number	Percent	Number	Percent
General Laborers	17	15.0	15	11.7
Electricians and Engineers	12	10.6	8	6.3
Office and Management Personnel	22	19.5	27	21.1
Mechanics, Welders, and Carpenters	22	19.5	17	13.3
Equipment Operators	28	24.8	32	25.0
Operating Technicians	5	4.2	19	14.8
Miscellaneous	4	3.5	6	4.7
No Answer	3	2.7	4	3.1
TOTAL	113	100.0	128	100.0

Local operating employees had worked an average of 45.8 months and nonlocal employees 44.0 months for their previous employer. Over 83 percent of the local and 49.2 percent of the nonlocal workers' previous job location was Wyoming.

Local operating workers had worked an average of 16.3 months and nonlocal workers 25.9 months with their present employer. Over 42 percent of the local and 46.1 percent of the nonlocal workers had held more than one position with their present company, with the local workers having an average of 1.7 positions and the nonlocal workers 2.3 positions. Local operating workers earned an average of $7.30 an hour, and nonlocal workers $7.87 an hour. Over 51 percent of the local and 60.2 percent of the nonlocal workers earned between $7.00 and $8.99 an hour (Table 20).

TABLE 20. HOURLY EARNINGS OF LOCAL AND NONLOCAL COAL INDUSTRY EMPLOYEES, ROCK SPRINGS, WYOMING, 1976

Hourly Rate	Local		Nonlocal	
	Number	Percent	Number	Percent
0-$4.99	10	8.8	7	5.5
$5.00-$5.99	11	9.7	5	3.9
$6.00-$6.99	23	20.4	12	9.4
$7.00-$7.99	25	22.1	39	30.5
$8.00-$8.99	33	29.2	38	29.7
Over $9.00	10	8.8	25	19.5
No Answer	1	0.9	2	1.6
TOTAL	113	100.0	128	100.0

Local workers made up a higher percentage of the employees in the equipment operator and general laborer categories than did nonlocal workers, while the nonlocal workers included a higher percentage of control and auxiliary operators and managers and foremen than the local workers (Table 21). This may be due to some of the employees in the management and operating classifications having transferred from similar jobs at different locations.

Over 81 percent of both the local and nonlocal workers commuted from 31 to 40 miles one way to work each day (Table 22). The local workers commuted an average of 36.4 miles per day and the nonlocal workers 34.9 miles. Over 76 percent of the local workers and 75.0 percent of the nonlocal workers commuted in car pools and most of the rest commuted in private automobiles.

TABLE 21. PRESENT JOB CLASSIFICATION OF LOCAL AND NONLOCAL COAL INDUSTRY EMPLOYEES, ROCK SPRINGS, WYOMING, 1976

Present Job Classifications	Local		Nonlocal	
	Number	Percent	Number	Percent
Control and Auxiliary Operators	17	15.0	31	24.2
Dragline or Shovel Operators	13	11.5	7	5.5
General Laborers	11	9.7	8	6.3
Mechanics, Welders, Carpenters	18	15.9	20	15.6
Electricians, Engineers, and Boiler Attendants	8	7.1	9	7.0
Managers and Foremen	5	4.4	11	8.6
Dozer Operators and Equipment Operators	29	25.7	27	21.1
Driller or Shooter	6	5.3	9	7.0
Miscellaneous	6	5.3	6	4.7
TOTAL	113	100.0	128	100.0

TABLE 22. DISTANCE TRAVELED TO WORK BY LOCAL AND NONLOCAL COAL INDUSTRY EMPLOYEES, ROCK SPRINGS, WYOMING, 1976

Distance Traveled	Local		Nonlocal	
	Number	Percent	Number	Percent
1-10 Miles	0	0.0	5	3.9
11-20 Miles	0	0.0	0	0.0
21-30 Miles	13	11.5	11	8.6
31-40 Miles	92	81.4	104	81.3
41-60 Miles	5	4.4	8	6.3
Over 61 Miles	2	1.8	0	0.0
No Answer	1	0.9	0	0.0
TOTAL	113	100.0	128	100.0

Residential Patterns

Since the Jim Bridger Power Plant is a mine-mouth operation, the mine and plant employees were grouped together for discussion of residential patterns. Most of both the local and nonlocal employees--82.3 percent and 86.7 percent, respectively--lived in Rock Springs which is located 37 miles from the Jim Bridger site (Table 23). However, Rock Springs is the only community with over 300 residents within 50 miles of the site. The location of plant and mine and surrounding communities are shown in Figure 3.

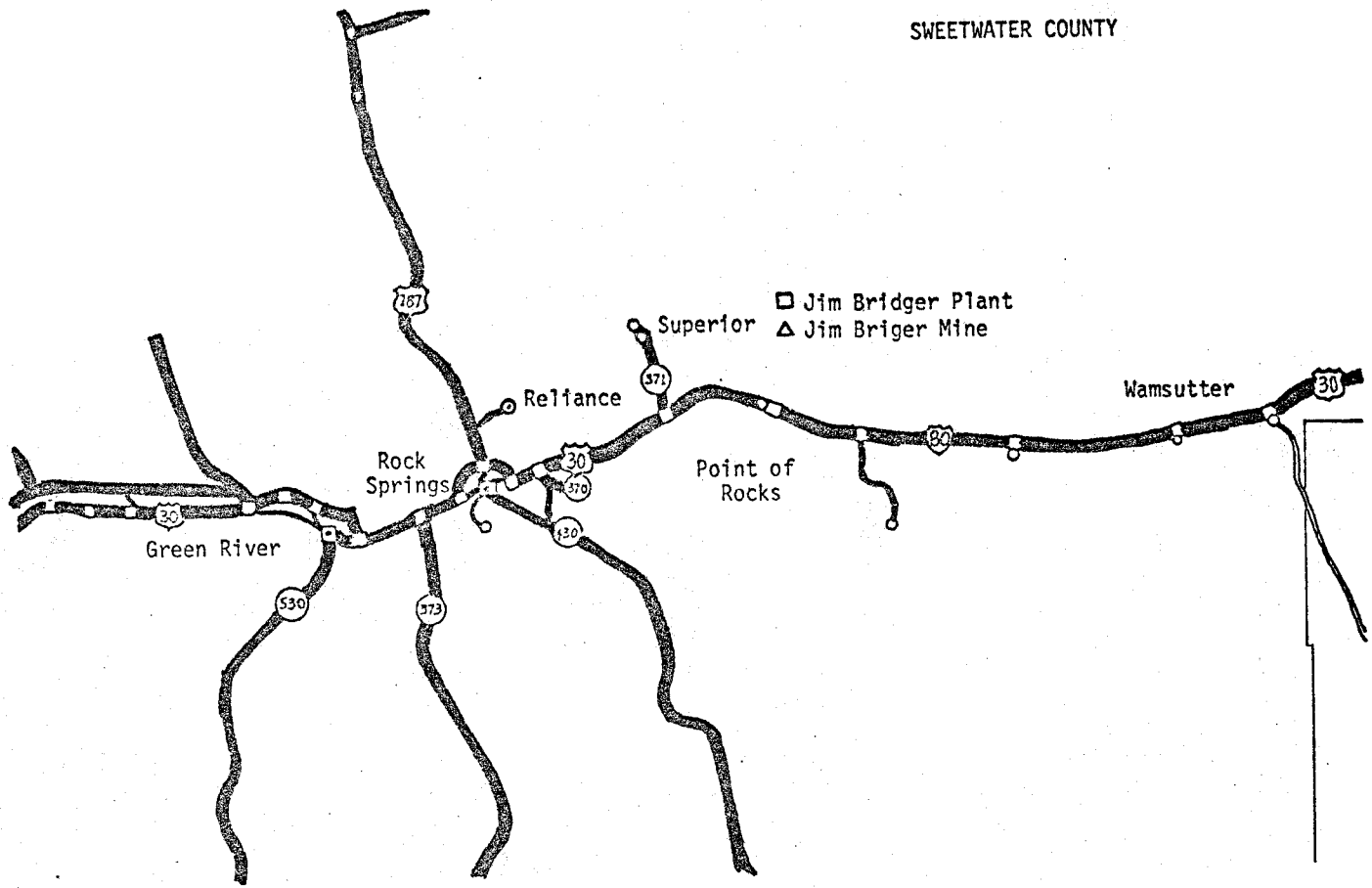

Figure 3. Location of Jim Bridger Power Plant and Coal Mine, Sweetwater County, Wyoming, 1976

TABLE 23. PLACE OF RESIDENCE OF COAL INDUSTRY OPERATING EMPLOYEES FOR TOTAL, LOCAL, AND NONLOCAL WORKERS, JIM BRIDGER PLANT AND MINE, ROCK SPRINGS, WYOMING, 1976

City	Miles From Site	1970 Population	Total		Local		Nonlocal	
			Number	Percent	Number	Percent	Number	Percent
Rock Springs	37	12,000	204	84.6	93	82.3	111	86.7
Superior	23	197	14	5.8	10	8.8	4	3.1
Green River	53	4,196	8	3.3	4	3.5	4	3.1
Reliance	40	300	7	2.9	4	3.5	3	2.3
Pt. of Rocks	8	35	3	1.2	0	0.0	3	2.3
Wamsatter	50	139	2	0.8	0	0.0	2	1.6
Eden	73	220	2	0.8	2	1.8	0	0.0
Bridger Hts.	50	50	1	0.4	0	0.0	1	0.8
TOTAL			241	100.0	113	100.0	128	100.0

Profile of Glenrock, Wyoming, Work Force

Sixty of the 155 employees at the Dave Johnson Power Plant and Mine at Glenrock were nonlocal workers. The local operating workers averaged 34.9 years of age and the nonlocal workers 35.1 years of age. Almost 79 percent of the local and 85.0 percent of the nonlocal workers were married (Table 24).

TABLE 24. MARITAL STATUS OF LOCAL AND NONLOCAL COAL INDUSTRY EMPLOYEES, GLENROCK, WYOMING, 1976

Marital Status	Local		Nonlocal	
	Number	Percent	Number	Percent
Married	74	78.7	51	85.0
Single	14	14.9	7	11.7
Widowed or Divorced	6	6.4	1	1.7
No Answer	0	0.0	1	1.7
TOTAL	94	100.0	60	100.0

The local workers had an average of 1.45 children per worker and the nonlocals 1.70 children per worker. All but one local and two nonlocal married workers had their families living with them in their present community. Married workers had an average family size of 3.86 for the local workers,

compared to 4.04 for the nonlocal employees.[13] Wyoming was the birthplace of 52.1 percent of the local and 30.0 percent of the nonlocal workers. Another 17 percent of the local and 26.7 percent of the nonlocal workers were born in one of the surrounding states. Over 55 percent of the local workers resided in a community of over 10,000 population, while only 20.0 percent of the nonlocal workers lived in a community of that size (Table 25). Another 40.4 percent of the local workers lived in a community with a population of 1,000 to 2,500, while 71.7 percent of the nonlocal workers lived in a community of that size.

TABLE 25. CITY SIZE OF RESIDENCE OF LOCAL AND NONLOCAL COAL INDUSTRY EMPLOYEES, GLENROCK, WYOMING, 1976

City Size of Residence	Local		Nonlocal	
	Number	Percent	Number	Percent
Farm	0	0.0	0	0.0
City Under 500 Population	1	1.1	0	0.0
City Between 500-1,000 Population	1	1.1	1	1.7
City Between 1,000-2,500 Population	38	40.4	43	71.7
City Between 2,500-5,000 Population	2	2.1	4	6.7
City Between 5,000-10,000 Population	0	0.0	0	0.0
City Over 10,000 Population	52	55.3	12	20.0
No Answer	0	0.0	0	0.0
TOTAL	94	100.0	60	100.0

Over 69 percent of the local and 70.0 percent of the nonlocal workers owned a single family home, while 10.7 percent of the local and 13.4 percent of the nonlocal workers rented some type of housing (Table 26).

Both local and nonlocal employees showed high levels of educational attainment with 93.5 percent of the local and 93.3 percent of the nonlocal employees having completed high school (Table 27). Almost 40 percent of the local and 51.7 percent of the nonlocal workers had received formal education beyond high school.

The previous job category of local employees consisted of 25.5 percent office and management personnel, 22.3 percent equipment operators, and 19.1 percent general laborers (Table 28). Of the nonlocal workers,

[13]Family size consisted of married employees currently living with their families, spouses, and children.

18.3 percent had previously been employed as office and management personnel; 18.3 percent as mechanics, welders, and carpenters; 16.7 percent as operating technicians; and 16.7 percent general laborers.

TABLE 26. PRESENT HOUSING OF LOCAL AND NONLOCAL COAL INDUSTRY EMPLOYEES, GLENROCK, WYOMING, 1976

Present Housing	Local		Nonlocal	
	Number	Percent	Number	Percent
Own House	65	69.1	42	70.0
Own Mobile Home	14	14.9	8	13.3
Own Other[a]	5	5.3	0	0.0
Rent Apartment	6	6.4	1	1.7
Rent House	3	3.2	7	11.7
Rent Mobile Home	1	1.1	0	0.0
Rent Other	0	0.0	0	0.0
No Answer	0	0.0	2	3.3
TOTAL	94	100.0	60	100.0

[a]"Own other" category includes condominiums, duplexes, and fourplexes.

TABLE 27. YEARS OF FORMAL EDUCATION OF LOCAL AND NONLOCAL COAL INDUSTRY EMPLOYEES, GLENROCK, WYOMING, 1976

Years of Formal Education	Local		Nonlocal	
	Number	Percent	Number	Percent
8 Years or Less	1	1.1	1	1.7
9-11 Years	4	4.3	1	1.7
12 Years	51	54.3	25	41.7
13-14 Years	34	36.2	24	40.0
16 or More Years	3	3.2	7	11.7
No Answer	1	1.1	2	3.3
TOTAL	94	100.0	60	100.0

The local operating employees had worked an average of 45.3 months and the nonlocal workers 41.0 months for their previous employer. Over 87 percent of the local workers and 55.0 percent of the nonlocal employees' previous job location was Wyoming.

The local operating workers had worked an average of 62.4 months and the nonlocal workers 88.2 months for their present employer. Almost 64 percent of the local and 71.7 percent of the nonlocal workers had held more than one position with their present company. The local workers had

averaged 2.8 positions and the nonlocal workers 2.9 positions with their present company. The local workers earned an average of $7.31 per hour and the nonlocal workers $8.18 per hour (Table 29). The nonlocal workers were consistently in higher earning categories than local workers with 28.3 percent of the nonlocal workers earning over $9.00 an hour.

TABLE 28. PREVIOUS JOB CLASSIFICATION OF LOCAL AND NONLOCAL COAL INDUSTRY EMPLOYEES, GLENROCK, WYOMING, 1976

Job Classifications	Local		Nonlocal	
	Number	Percent	Number	Percent
General Laborer	18	19.1	10	16.7
Electricians and Engineers	6	6.4	4	7.7
Office and Management Personnel	24	25.5	11	18.3
Mechanics, Welders, and Carpenters	18	19.1	11	18.3
Equipment Operators	21	22.3	9	15.0
Operating Technicians	3	3.2	10	16.7
Miscellaneous	3	3.2	3	5.0
No Answer	1	1.1	2	3.3
TOTAL	94	100.0	60	100.0

TABLE 29. HOURLY EARNINGS OF LOCAL AND NONLOCAL COAL INDUSTRY EMPLOYEES, GLENROCK, WYOMING, 1976

Hourly Rate	Local		Nonlocal	
	Number	Percent	Number	Percent
$0-$4.99	7	7.4	1	1.7
$5.00-$5.99	5	5.3	1	1.7
$6.00-$6.99	23	24.5	8	13.3
$7.00-$7.99	23	24.5	8	13.3
$8.00-$8.99	28	29.8	23	38.3
Over $9.00	7	7.4	17	28.3
No Answer	1	1.1	2	3.3
TOTAL	94	100.0	60	100.0

Almost 28 percent of the local workers were dozer or equipment operators; 19.1 percent mechanics, welders, and carpenters; and 18.1 percent control and auxiliary operators (Table 30). Over 28 percent of the nonlocal workers were control and auxiliary operators, while 25 percent were mechanics, welders, and carpenters.

TABLE 30. PRESENT JOB CLASSIFICATION OF LOCAL AND NONLOCAL COAL INDUSTRY EMPLOYEES, GLENROCK, WYOMING, 1976

Present Job Classifications	Local		Nonlocal	
	Number	Percent	Number	Percent
Control and Auxiliary Operator	17	18.1	17	28.3
Dragline or Shovel Operator	5	5.3	4	6.7
General Laborer	9	9.6	3	5.0
Mechanics, Welders, Carpenters	18	19.1	15	25.0
Electricians, Engineers, and Boiler Attendants	5	5.3	9	15.0
Managers and Foremen	4	4.3	4	6.7
Dozer Operators and Equipment Operators	26	27.7	6	10.0
Driller or Shooter	3	3.2	0	0.0
Miscellaneous	7	7.4	2	3.3
TOTAL	94	100.0	60	100.0

The local workers commuted considerably longer distances than the nonlocal workers. Almost 60 percent of the local workers commuted from 21 to 40 miles to work, while only 31.6 percent of the nonlocal workers commuted within that range (Table 31). The local workers commuted an average of 21.9 miles per day (one way) and the nonlocal workers 14.1 miles to work. Almost 60 percent of the local and 40 percent of the nonlocal workers traveled to work in car pools. This may indicate that since local workers travel farther to work they tend to travel together in order to minimize travel expenses.

TABLE 31. DISTANCE TRAVELED TO WORK BY LOCAL AND NONLOCAL COAL INDUSTRY EMPLOYEES, GLENROCK, WYOMING, 1976

Distance Traveled	Local		Nonlocal	
	Number	Percent	Number	Percent
1-10 Miles	33	35.1	37	61.7
11-20 Miles	4	4.3	4	6.7
21-30 Miles	30	31.9	14	23.3
31-40 Miles	26	27.7	5	8.3
41-60 Miles	1	1.1	0	0.0
Over 61 Miles	0	0.0	0	0.0
No Answer	0	0.0	0	0.0
TOTAL	94	100.0	60	100.0

Residential Patterns

The Dave Johnson Mine that fuels the power plant is located approximately 14 miles north of the Dave Johnson Power Plant. Therefore, the residential patterns are discussed separately. The Glenrock area is somewhat different from the Rock Springs area in that there are several possible choices of residence. Over 72 percent of the nonlocal power plant employees lived in Glenrock, while only 41.7 percent of the local workers lived there (Table 32). The nonlocal employees tended to live close to their place of employment with only 19.1 commuting the 30 miles to Casper, while 51.7 percent of the local workers lived in Casper.

TABLE 32. PLACE OF RESIDENCE OF COAL INDUSTRY OPERATING EMPLOYEES FOR TOTAL, LOCAL, AND NONLOCAL WORKERS, DAVE JOHNSON PLANT, GLENROCK, WYOMING, 1976

City	Miles From Site	1970 Population	Total		Local		Nonlocal	
			Number	Percent	Number	Percent	Number	Percent
Casper	26	39,500	40	37.0	31	51.7	9	19.1
Glenrock	7	1,515	60	55.6	25	41.7	34	72.3
Douglas	20	2,677	4	3.7	1	1.7	3	6.4
Evansville	22	832	2	1.9	1	1.7	1	2.1
Shawnee	51	25	1	0.9	1	1.7	0	0.0
Mills	30	1,593	1	0.9	1	1.7	0	0.0
TOTAL			108	100.0	60	100.0	47	100.0

Employees at the Dave Johnson Mine showed the same residential preferences as power plant employees. Nine of the 13 nonlocal workers settled in Glenrock with 21 of the 34 local workers (61.8 percent) residing in Casper (Table 33). The locations of plant, mine, and surrounding communities are shown in Figure 4.

TABLE 33. PLACE OF RESIDENCE OF COAL INDUSTRY OPERATING EMPLOYEES FOR TOTAL, LOCAL, AND NONLOCAL WORKERS, DAVE JOHNSON MINE, GLENROCK, WYOMING, 1976

City	Miles From Site	1970 Population	Total		Local		Nonlocal	
			Number	Percent	Number	Percent	Number	Percent
Casper	38	39,500	24	51.1	21	61.8	3	23.1
Glenrock	18	1,515	20	42.6	11	32.4	9	69.2
Douglas	24	2,677	2	4.3	1	2.9	1	7.7
Mills	40	1,593	1	2.1	1	2.9	0	0.0
TOTAL			47	100.0	34	100.0	13	100.0

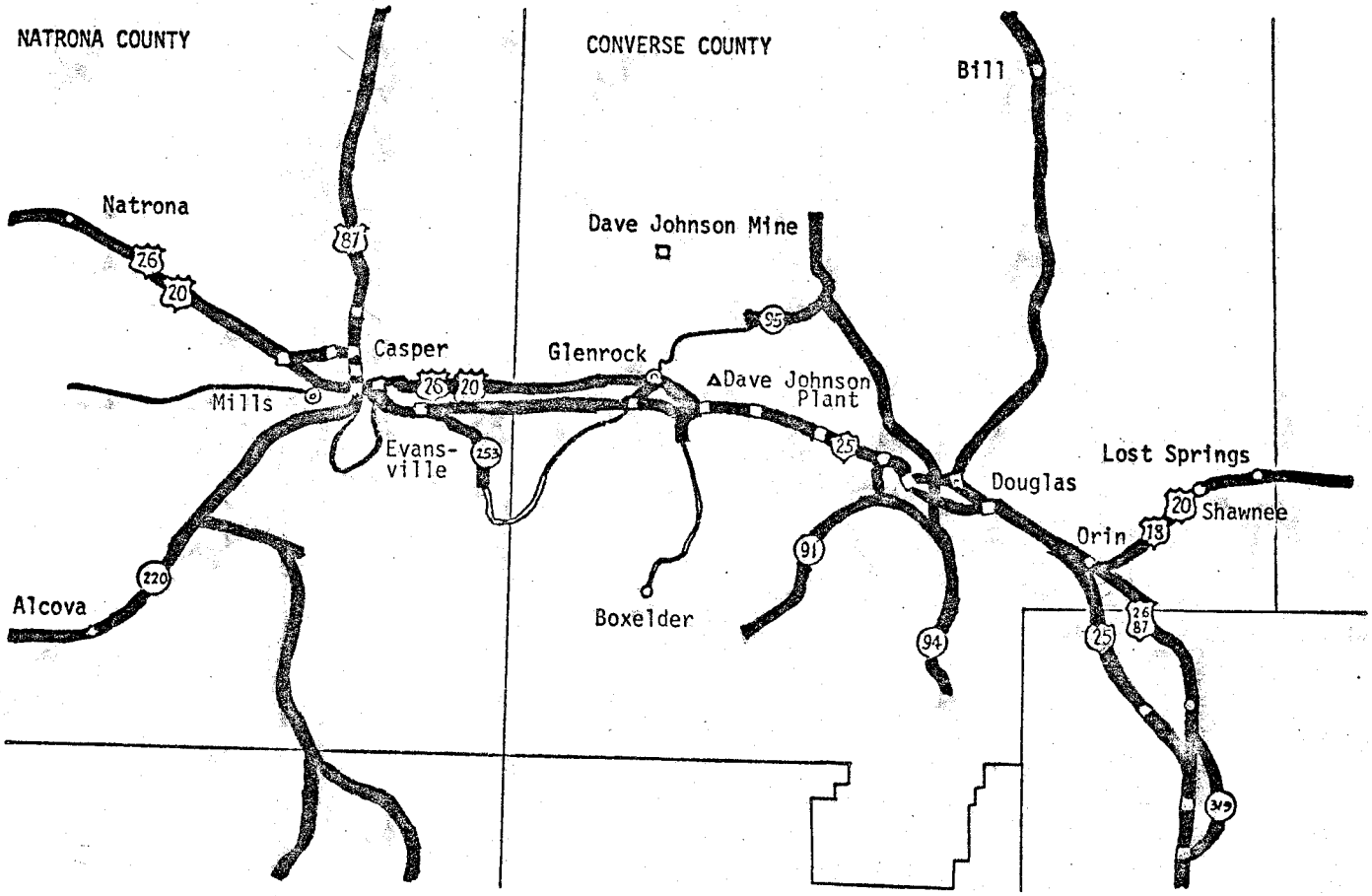

Figure 4. Location of Dave Johnson Power Plant and Coal Mine, Natrona and Converse Counties, Wyoming, 1976

Profile of Decker Coal Mine Work Force

Workers at Decker Coal Company's Decker Mine were surveyed in 1975. Decker Coal Company is a subsidiary of Peter Kiewit and Sons. The questionnaire was designed and administered by Decker Coal Company officials (Appendix D) and was subtantially different from the instrument used at the other sites, but since many of the questions were the same, data from the Decker surveys were used.

Eighty-one of the 116 Decker employees who answered the questionnaire were local workers. Almost 93 percent of the local and 97.1 percent of the nonlocal workers were male. Over 38 percent of the local and 48.6 percent of the nonlocal employees were between the ages of 26 and 35 (Table 34). Eighty-four percent of the local and 91.4 percent of the nonlocal workers were married (Table 35). Average family size was 3.22 for local and 3.20 for nonlocal workers.

TABLE 34. AGE CATEGORY OF LOCAL AND NONLOCAL COAL INDUSTRY EMPLOYEES, DECKER COAL MINE, DECKER, MONTANA, 1975

Age Category	Local		Nonlocal	
	Number	Percent	Number	Percent
18-25	17	21.0	7	20.0
26-35	31	38.3	17	48.6
36-45	13	16.0	3	8.6
Over 45	20	24.7	8	22.9
TOTAL	81	100.0	35	100.0

SOURCE: Survey conducted by Decker Coal Company officials.

TABLE 35. MARITAL STATUS OF LOCAL AND NONLOCAL COAL INDUSTRY EMPLOYEES, DECKER COAL MINE, DECKER, MONTANA, 1975

Marital Status	Local		Nonlocal	
	Number	Percent	Number	Percent
Married	68	84.0	32	91.4
Single	10	12.3	3	8.6
Divorced	3	3.7	0	0.0
No Answer	0	0.0	0	0.0
TOTAL	81	100.0	35	100.0

SOURCE: Survey conducted by Decker Coal Company officials.

Nonlocal workers had been employed longer with Peter Kiewit and Sons than local workers. Almost 31 percent of the local workers and 17.1 percent of the nonlocal workers had been employed with the company from one to two years, while 21.0 percent of the local and 31.4 percent of the nonlocal workers had been employed with Peter Kiewit and Sons for over five years (Table 36).

TABLE 36. LENGTH OF EMPLOYMENT OF LOCAL AND NONLOCAL COAL INDUSTRY EMPLOYEES, DECKER COAL MINE, DECKER, MONTANA, 1975

Length of Employment	Local		Nonlocal	
	Number	Percent	Number	Percent
0-6 Months	8	9.9	4	11.4
6-12 Months	14	17.3	4	11.4
1-2 Years	25	30.9	6	17.1
2-5 Years	14	17.3	10	28.6
Over 5 Years	17	21.0	11	31.4
No Answer	3	3.7	0	0.0
TOTAL	81	100.0	35	100.0

SOURCE: Survey conducted by Decker Coal Company officials.

Two-thirds of the local workers, but only 25.7 percent of the nonlocal workers, were born in either Montana or Wyoming. Over 50 percent of the local and 31.4 percent of the nonlocal employees owned a home, another 16 percent of the local and 31.4 percent of the nonlocal workers owned a mobile home (Table 37). Forty-two percent of the local workers and 31.4 percent of the nonlocal workers had 12 years of education, while 33.3 percent of the local and 40.0 percent of the nonlocal workers had 13 or more years of education (Table 38). Over 17 percent of the local and 14.3 percent of the nonlocal workers had vocational or technical training. The local employees earned an average of $317 a week while the nonlocal employees' weekly earnings were $310.

Residential Patterns

The Decker Coal Mine is located in an area having characteristics similar to the Jim Bridger Plant and Mine area. Only one community, Sheridan, has a population of over 300 people within 30 miles of the site.

As a result 76.5 percent of the local and 74.3 percent of the nonlocal workers lived in Sheridan, which is approximately 23 miles from the mine (Table 39). Almost 14 percent of the local and 17.1 percent of the nonlocal workers live in the rural areas of Montana and their residential location could not be more clearly specified from the questionnaire data. The location of the mine and surrounding cities are shown in Figure 5.

TABLE 37. PRESENT HOUSING OF LOCAL AND NONLOCAL COAL INDUSTRY EMPLOYEES, DECKER COAL MINE, DECKER, MONTANA, 1975

Present Housing	Local		Nonlocal	
	Number	Percent	Number	Percent
Own House	41	50.6	11	31.4
Own Mobile Home	13	16.0	11	31.4
Own Other	3	3.7	0	0.0
Rent Apartment	6	7.4	7	20.0
Rent Home	15	18.5	4	11.4
Rent Mobile Home	1	1.2	1	2.9
Rent Other	1	1.2	1	2.9
No Answer	1	1.2	0	0.0
TOTAL	81	100.0	35	100.0

SOURCE: Survey conducted by Decker Coal Company officials.

TABLE 38. LAST YEAR OF EDUCATION OF LOCAL AND NONLOCAL COAL INDUSTRY EMPLOYEES, DECKER COAL MINE, DECKER, MONTANA, 1975

Last Year Completed	Local		Nonlocal	
	Number	Percent	Number	Percent
8th Grade	6	7.4	5	14.3
12th Grade	34	42.0	11	31.4
2 Years College	15	18.5	8	22.9
4 Years College	9	11.1	6	17.1
Over 4 Years College	3	3.7	0	0.0
Vocational and Technical School	14	17.3	5	14.3
TOTAL	81	100.0	35	100.0

SOURCE: Survey conducted by Decker Coal Company officials.

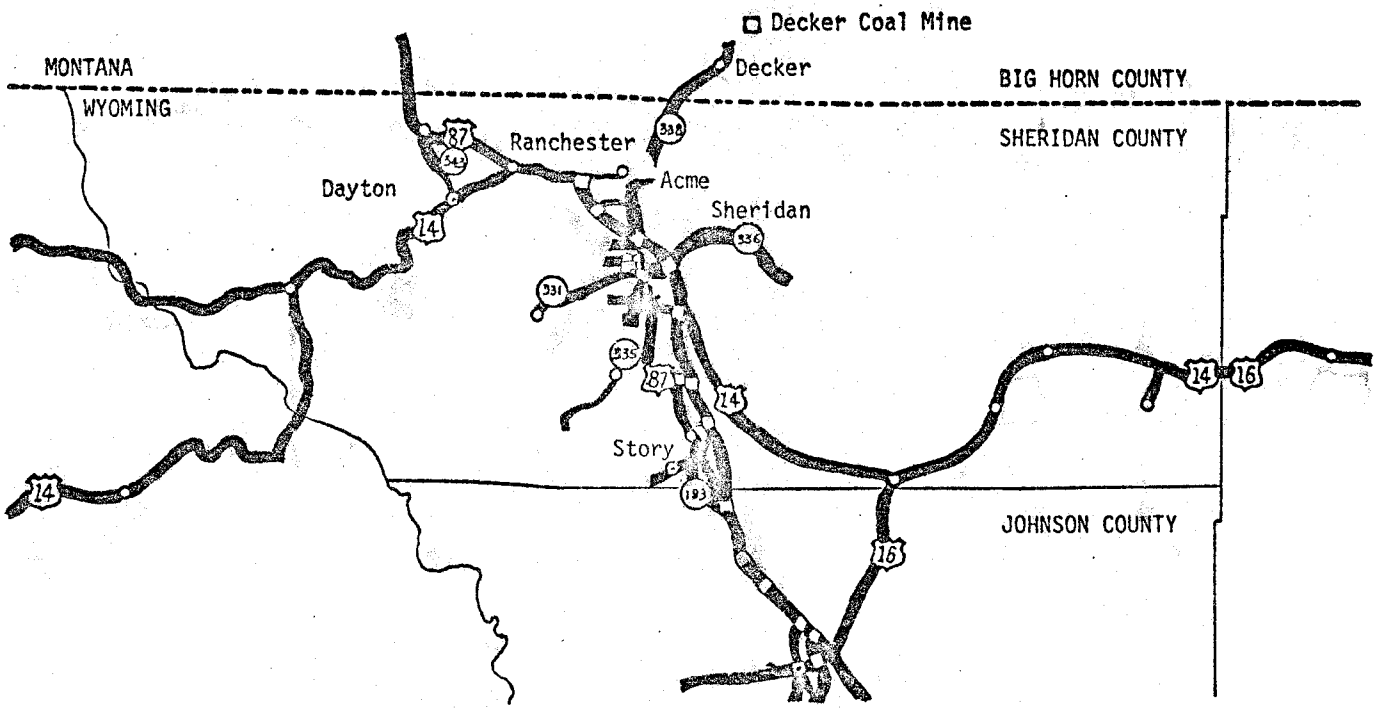

Figure 5. Location of Decker Coal Mine, Big Horn County, Montana, 1976

TABLE 39. PLACE OF RESIDENCE OF COAL INDUSTRY EMPLOYEES FOR TOTAL, LOCAL, AND NONLOCAL WORKERS, DECKER COAL MINE, DECKER, MONTANA, 1975

City	Miles From Site	1970 Population	Total		Local		Nonlocal	
			Number	Percent	Number	Percent	Number	Percent
Sheridan	23	10,900	88	75.9	62	76.5	26	74.3
Acme	15	100	4	3.4	2	2.5	2	5.7
Story	32	400	3	2.6	3	3.7	0	0.0
Ranchester	25	208	2	1.7	1	1.2	1	2.9
Dayton	31	396	2	1.7	2	2.5	0	0.0
Rural Montana			17	14.7	11	13.6	6	17.1
TOTAL			116	100.0	81	100.0	35	100.0

SOURCE: Survey conducted by Decker Coal Company officials.

Model Development

This section presents the conceptual framework of the two models developed in this study. The models were used to address two major questions: 1) how many local workers will each community supply to a project site; and 2) once the number of nonlocal workers is known, where will they settle? Local workers consist of those who would be willing to leave their present employment for work at the project site. Because of the coal industry's high wages, it was hypothesized that many local workers would be willing to commute moderate distances to a project site.

Local Labor Supply Model

The local labor supply model is designed to estimate the number of local workers that will be supplied by local communities to work on a given project. A local worker was defined as an employee who did not change his location of residence to work at the project site. An employee who changed his location of residence to work at the project site was classified as a nonlocal worker. The objective in developing the local labor supply model was to determine whether variation in the number of local workers from project to project can be explained by the characteristics of the projects and the communities surrounding them.

A review of studies on local labor markets indicated that the following variables may be important: community population, distance from residence to work, project size, number of employees at other projects in the area,

population of an area, the number of underemployed workers, and the current wage level in the area (Dobbs and Kiner, 1974; Lonsdale, 1966; Clemente and Summers, 1973). Population is important as a measure of the size of the work force that would potentially be available for hire. The hypothesis is that the larger the population of a community, the more local workers will be hired from the community to work on a project.

Review of previous studies indicated that most individuals consider commuting to be an undesirable task. This indicates an inverse relationship exists between the number of local workers and the distance they live from the project site. The farther a community is from a project site, the fewer local workers that community would be expected to supply to the project.

Project size is an important variable if the local labor supply model is to be applied to a variety of projects. This variable standardizes the model for both large and small projects. One would hypothesize a positive relationship between project size and number of local workers supplied by a community. The larger the project size the greater the number of local workers that a community will potentially supply because of increased job opportunities.

The number of workers employed at other energy related projects in the area will affect the number of local workers supplied by a community. The hypothesis is that the more projects there are in an area, the fewer workers a local community will supply to a given project because local workers will have more than one project site for possible employment. Therefore, a negative relationship is expected to exist between the number of workers employed at area projects and the number of local workers each community will supply to a given project.

The population of other communities in a commuting region is hypothesized to have a negative relationship with the number of local workers supplied. The more people in the area available for employment, the fewer workers each community will supply because more competition exists for available jobs.

There is a substantial number of underemployed workers in many of the western coal development areas. Many of these workers may have skills required for coal industry employment. However, the amount of underemployment in an area is difficult to measure. One potential measure is the

number of weeks worked in the past year. However, these data are not available for the smaller communities in the coal development areas. Another potential measure, and the one used in this study, is the current area wage level. Current wage levels of coal industry employees are high relative to wage levels of employees in other occupations in coal development areas. The hypothesis is that the greater this difference in wages, the more underemployment that exists and the more workers each community will potentially supply.

The following hypotheses were developed to indicate the relationships between variables:

Hypothesis 1: There is a positive relationship between the number of local workers supplied by community i to project j (LW_{ij}) and the size of community i (POP_i).

Hypothesis 2: There is an inverse relationship between the number of local workers supplied by community i to project j and the distance between i and j (D_{ij}).

Hypothesis 3: There is a positive relationship between the number of local workers supplied by community i to project j and the total number of workers on project j (EMP_j).

Hypothesis 4: To the extent that workers from community i are already employed on energy-related projects other than j (ΣEMP), LW_{ij} will be diminished.

Hypothesis 5: The larger the total population of other communities (ΣPOP) within the project's commuting region, the smaller will be LW_{ij}. This hypothesis takes into account the possibility that the number of jobs available to residents of a community may be limited if there are large competing sources of supply within the area.

Hypothesis 6: There is an inverse relationship between the community's wage level (WL_i) and the number of workers that will be supplied to a project (LW_{ij}).

In summary, the model and the hypothesized relationships are as follows:

$$LW_{ij} = a_0 + a_1 POP_i + a_2 D_{ij} + a_3 EMP_j + a_4 \Sigma EMP + a_5 \Sigma POP + a_6 WL_i$$

Where: a_2, a_4, a_5, and a_6 are expected to be negative; and a_1, and a_3 are exptected to be positive.

Where: LW_{ij} = the number of local workers supplied by community i to project j

POP_i = the population of community i

D_{ij} = the distance between community i and project j

EMP_j = the number of employees at project j

ΣEMP = the total number of employment at other energy related projects in the area

ΣPOP = the total population of other communities in the area

WL_i = the wage level of community i

Observations for testing the model consisted of those communities with local workers working on a project or plant site. Special census data were available for only a few communities. Thus to be consistent, the 1970 census of population was used in measuring POP_i. The number of employees working on a project at the time it was surveyed provided the estimate of EMP_j. Distance (D_{ij}) was the calculated road mileage between the community and project sites, determined by using mileages from state highway maps. The population of other communities in the region (ΣPOP) consisted of the sum of the population of communities within the commuting region of a project or plant.[14] The total number of workers employed at other projects (ΣEMP) consisted of the number of employees working at all energy-related project sites within the commuting region. Most communities had relatively small populations and data on current wage levels by community were not available. County estimates of wages and salaries in 1974 were divided by wage and salary employment which was available from the Bureau of Economic Analysis, U.S. Department of Commerce, to provide an estimate of wage levels for each county. Every community in a county was assigned the same wage level.

Ordinary least squares was used to estimate coefficients of the regional model and also for models for each of the areas, except the Decker area, where there were not sufficient data for computation.

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[14]The commuting region includes all communities from which it would be reasonable to commute daily to the place of employment. For this study, the commuting region was confined to 40 miles.

Regional Model

Data from all operating sites provided 54 observations on LW_{ij}. The empirical results are shown below with the calculated t-ratios in parentheses.[15]

$$LW_{ij} = \underset{}{1.2630} + \underset{(4.93)}{.0020}\ POP_i + \underset{(3.17)}{.1551}\ EMP_j - \underset{(-2.60)}{.6324}\ D_{ij} - \underset{(-.93)}{.0007}\ \Sigma POP +$$

$$\underset{(.40)}{.0028}\ \Sigma EMP + \underset{(.38)}{.0010}\ WL_i \qquad F\ Value = 6.24$$

The coefficient of determination (R^2) is the amount of total variation in LW_{ij} that can be explained by the equation. The coefficient of determination was .443. In other words the equation accounted for 44.3 percent of the variation of LW_{ij}. The coefficients on POP_i, EMP_j, and D_{ij} are significant at the .95 level, while the other independent variables were not significant. The hypothesized relationships exist for the significant variables in the equation. The best equation including only significant variables was:

$$LW_{ij} = \underset{}{7.2600} + \underset{(4.66)}{.0018}\ POP_i + \underset{(2.87)}{.1204}\ EMP_j - \underset{(-2.57)}{.5479}\ D_{ij} \qquad F\ Value = 11.21$$

This equation had an R^2 of .402 and explained almost as much of the variation in LW_{ij} as the total model.

North Dakota Model

Data from the North Dakota operating sites provided 28 observations on LW_{ij}. The results of the North Dakota model are shown below with the t-values in parentheses.[16]

$$LW_{ij} = \underset{}{-7.5142} + \underset{(1.01)}{.0014}\ POP_i + \underset{(.86)}{.2401}\ EMP_j - \underset{(-2.48)}{.5835}\ D_{ij} - \underset{(-.17)}{.0002}\ \Sigma POP -$$

$$\underset{(-.29)}{.0072}\ \Sigma EMP + \underset{(.98)}{.0019}\ WL_i \qquad F\ Value = 2.15$$

The coefficient of determination is .380 for the equation. However, the only variable that is significant at the .95 level is D_{ij}. In order to obtain a better equation, the stepwise regression procedure was used. The best equation with all coefficients significant to the .80 level is as follows:

$$LW_{ij} = \underset{}{2.6049} + \underset{(1.35)}{.0014}\ POP_i + \underset{(1.67)}{.2735}\ EMP_j - \underset{(-3.02)}{.6446}\ D_{ij} \qquad F\ Value = 4.26$$

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[15]With 47 degrees of freedom, the null hypothesis that b=0 can be rejected at the 95 percent level when $t<|2.021|$.

[16]With 21 degrees of freedom, the null hypothesis that b=0 can be rejected at the 95 percent level when $t<|2.080|$.

This equation had a coefficient of determination of .348. The hypothesized relationships exist for these three variables.

Glenrock Model

Data from the Dave Johnson Plant and Mine provided ten observations on LW_{ij}. Admittedly, this is a small number of observations; however, this is not a result of limited data but rather a result of limited communities in the area. Because the plant and mine are located within a few miles, two variables (EMP_j and ΣEMP) did not have any variation and were not included in the model. The results of the Glenrock model are shown below:[17]

$$LW_{ij} = 183.5720 + \underset{(4.06)}{.0014\ POP_i} - \underset{(-1.75)}{.6968\ D_{ij}} - \underset{(-.11)}{.0012\ \Sigma POP} - \underset{(-.50)}{.0111\ WL_i}$$

f Value = 5.61

The coefficient of determination is .818 for the equation. The hypothesized relationships hold for each of the variables. Caution is advised as only ten observations existed for testing of the model.

Rock Springs Model

Data from the Jim Bridger Plant and Mine provided nine observations on LW_{ij}. Again, this was not a problem of limited data but rather a result of only a few communities within the commuting area. Also, three variables (ΣEMP, ΣPOP, and WL_i) did not have any variation in the Rock Springs area and were not included in the model. The result of the Rock Springs model is shown below:[18]

$$LW_{ij} = 79.4188 + \underset{(6.46)}{.0048\ POP_i} - \underset{(-1.07)}{.3876\ EMP_j} - \underset{(-1.51)}{.3640\ D_{ij}} \qquad F\ Value = 14.91$$

The coefficient of determination is .899 for the equation. Again, the results are based on only nine observations and, therefore, caution is advised when interpreting them.

Summary of the Models

While it is obvious that much of the variance in the regional and North Dakota models is unexplained, the equations represent a start toward

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[17] With five degrees of freedom, the null hypothesis that b=0 can be rejected at the 95 percent level when $t<|2.571|$.

[18] With five degrees of freedom, the null hypothesis that b=0 can be rejected at the 95 percent level when $t<|2.571|$.

determining which variables are important in estimating the supply of local workers to a major operating site. The Glenrock and Rock Springs models explain much more of the variation in LW_{ij} than the others, but the models are based on so few observations that caution is advised. The hypothesized relationships existed for all significant variables in each model. The differences in the magnitude of the regression coefficients indicate the importance of site specific information in estimating labor supplies. Only two variables (POP_i and D_{ij}) played an important role in each of the equations. While these two variables seem most important in determining the number of local workers supplied by a community to a project, the remaining variables should not be overlooked in a regional labor supply model. A summary of the models is included in Table 40.

Residential Prediction Model

Once an estimate of the number of local workers expected on a project has been made, the next step is to determine the number of nonlocal workers required and where the workers will choose to live. Many studies have attempted to establish models of residential prediction for metropolitan or urban areas, but few studies have examined residential prediction in rural areas (Lonsdale, 1966; Old West, 1975).

The residential prediction model presented in this report represents an attempt to predict the community in which the new workers will choose to live within the commuting region. There are two components to be considered: 1) the number of nonlocal workers that will actually settle in a community (NL_i); and 2) the estimation of the attractiveness of that community (A_i). The model is based on the premise that the relative attractiveness of a community can be measured by the number of nonlocal workers on a given project that settle in a community.

Specifically:

$$NL_i = \left[\frac{Ai}{A}\right] TNL$$

Where: NL_i = the number of nonlocal workers settling in community i

A_i = the attractiveness of community i

A = the sum of A_i over all the communities in the commuting region

TNL = the total number of nonlocal workers that are required on a project

TABLE 40. SUMMARY OF REGRESSION COEFFICIENTS FOR THE LOCAL LABOR SUPPLY MODEL

Area	Variables								
	Intercept	POP_j	EMP_j	D_{ij}	ΣPOP	ΣEMP	WL	Observations	R^2
North Dakota	- 7.5142	.0014 (1.01)	.2401 (.86)	- .5835 (-2.48)	.0002 (-.17)	-.0072 (-.29)	.0019 (.98)	28	.380
Glenrock	183.5720	.0014 (4.06)		- .6968 (-1.75)	-.0012 (-.11)		-.0111 (-.50)	10	.818
Rock Springs	79.4188	.0048 (6.46)	.3876 (-1.07)	.3640 (-1.51)				9	.899
TOTAL	1.2630	.0020 (4.93)	.1551 (3.17)	- .6324 (-2.60)	.0007 (-.93)	.0028 (.40)	.0010 (.38)	54	.443

The population of a community is an important factor in estimating the attractiveness of a community (A_i) in a residential choice model. Anderson concluded that population appears to be the basic quantitative measure of a city's services and size of potential labor force and that other factors may modify the influence of population but will not negate it.[19] The larger a community's population, the more services it has to offer and the more attractive that community is as a place to live.[20] A positive relationship was hypothesized between a community's population and the number of nonlocal workers that will reside in that community.

The distance the community is located from the project site is a key factor in the model for the same reasons given for the local labor supply model. A negative relationship was hypothesized between distance and the number of nonlocal workers that reside in a community.

The distance a community is located from the regional trade center would seem to be important for this study area.[21] Since many of the project sites are located long distances from trade centers, it was hypothesized that the worker will try to maximize utility by choosing a location that allows him to be within commuting distance of both his place of work and the regional trade center. This locational choice would allow him to minimize both his and his family's travel time.

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[19] Anderson, Theodore R., "Intermetropolitan Migration: A Comparison of the Hypotheses of Zipf and Stouffer," American Sociological Review, Vol. 20, 1955, pp. 287-291.

[20] At higher population levels this relationship may not hold true.

[21] A trade center was defined by Borchert and Adams as having nine or more of the following retail functions:

(1) Photographic Studio
(2) Sporting Goods
(3) Family Shoe Store
(4) Florist
(5) Radio and TV Store
(6) Tires, Batteries, and Accessories
(7) Paint, Glass, and Wallpaper
(8) Music Store
(9) Children's Wear
(10) Heating and Plumbing Equipment
(11) Antique or Second-hand Store
(12) Stationery
(13) Women's Accessories
(14) Camera Shop

or, $11 million annually in retail sales and at least six of the above retail functions. For further information, see Borchert, John R., and Russell B. Adams, Trade Centers and Trade Areas of the Upper Midwest, Upper Midwest Economic Study, Urban Report Number 3, September, 1963.

Summarizing, the attractiveness of an individual community can be stated as:[22]

$$A_i = \frac{POP_i}{D_{ij}^{\beta j} D_{it}^{\beta t}}$$

Where: A_i = the attractiveness of the ith community

POP_i = population of community i

D_{ij} = distance between community i and project j

β_j = commuting distance elasticity which measures the responsiveness of nonlocal workers to distance from the project site

D_{it} = distance between community i and the nearest regional trade center (t)

β_t = trade center distance elasticity which measures the responsiveness of nonlocal workers to distance from the regional trade center

The model assumes that the attractiveness of the ith community as a place of residence for nonlocal workers from the jth project is related to the size of the community (POP_i), the distance separating the community and the project (D_{ij}), and the distance separating the community from the regional trade center (D_{it}).

The assumption is that the number of nonlocal residents who reside in community X (NL_X) compared to the number that reside in community Y (NL_Y) is a reflection of the attractiveness of community X (A_X) relative to community Y (A_Y). Specifically:

$$\frac{NL_X}{NL_Y} = \frac{A_X}{A_Y} \quad \text{or} \quad \frac{NL_X}{NL_Y} = \frac{POP_X / D_{Xj}^{\beta j} D_{Xt}^{\beta t}}{POP_Y / D_{Yj} D_{Y_t}}$$

Ordinary least squares can be used to estimate the distance elasticities (βj and βt) once the above equation is made linear through use of logarithmic transformations. For example:

$$\log NL_x - \log NL_y = (\log POP_x - \log POP_y) - \beta j(\log D_{xj} - \log D_{yj}) - \beta t(\log D_{xt} - \log D_{yt})$$

---

[22] Because of the problem created when $D_{it}=0$ (i.e., the community is the trade center) or $D_{ij}=0$ (i.e., the project is located in the community), an arbitrary distance of one mile is assigned to this situation.

The model can also be specified using only POP and D_{ij} as determinants of community attractiveness. This relationship can be measured for any pair of communities x and y as shown below:

$$\frac{NLx}{NLy} = \frac{POP_x/D_{xj}^{\beta j}}{POP_y/D_{yj}^{\beta j}}$$

Observations consisted of every possible pair of communities within the commuting region of a project or site. The 1970 U.S. Census of Population was used in measuring POP_i; D_{ij}, and D_{it} were measured by road map mileage.

The validity of these models rests on the assumption that the relative attractiveness of a community increases with its size and proximity to the project site. The ability of communities to absorb new residents is hypothesized to be a function of the size of the community.

Regional Model

Data from the 15 operating sites provided 71 observations for estimating distance elasticity in the regional model. The regression results for the model are shown below:

$$\frac{NL_i}{NL_i} = \frac{POP_i/D_{ij}^{1.079}D_{it}^{-.181}}{POP_i/D_{ij}^{1.079}D_{it}^{-.181}}$$

The coefficient of determination was .590 and the distance elasticity value of D_{ij} and D_{it} had calculated t values of 8.08 and -1.61, respectively. The distance elasticity value on D_{it} is significant at the .80 level. The model was also tested without D_{it} as a variable. The results are as shown:

$$\frac{NL_i}{NL_i} = \frac{POP_i/D_{ij}^{1.170}}{POP_i/D_{ij}^{1.170}}$$

The coefficient of determination was .574 and the distance elasticity value of 1.170 was significant at the 99 percent level with a t-value of 9.64. This model explains almost as much of the variance as the model with D_{it}. Thus, one could conclude that for the regional model, D_{it} does not play a major role in determination of residential choice.

North Dakota Model

Data from eight North Dakota operating sites provided 21 observations to estimate β_j and β_t for North Dakota. The regression results are shown below:

$$\frac{NL_i}{NL_i} = \frac{POP_i/D_{ij}^{.619}D_{it}^{-1.100}}{POP_i/D_{ij}^{.619}D_{it}^{-1.100}}$$

The coefficient of determination was .648 with the estimates of distance elasticity on D_{ij} and D_{it} significant at the 99 percent level with t-values of 2.56 and -3.41, respectively. The results of the model with D_{it} excluded are as follows:

$$\frac{NL_i}{NL_i} = \frac{POP_i/D_{ij}^{.998}}{POP_i/D_{ij}^{.998}}$$

The coefficient of determination was .422 and the distance elasticity value of .998 was significant at the 99 percent level with a t-value of 3.72. For the North Dakota model, the model with D_{it} as a variable explained much more of the variance than the other model. This is expected since there are several communities within commuting distance of each site so that a worker can choose a place of residence that is close to both his place of employment and a regional trade center.

Glenrock Model

Data from the Dave Johnson Plant and Mine provided nine observations to estimate distance elasticities for the Glenrock model. The results from estimating the model are shown below:

$$\frac{NL_i}{NL_i} = \frac{POP_i/D_{ij}^{1.351}D_{it}^{-.851}}{POP_i/D_{ij}^{1.351}D_{it}^{-.851}}$$

The coefficient of determination is .859 with both D_{ij} and D_{it} significant at the 99 percent level with t-values of 4.22 and -4.15, respectively. The results of the model without D_{it} are as follows:

$$\frac{NL_i}{NL_i} = \frac{POP_i/D_{ij}^{1.403}}{POP_i/D_{ij}^{1.403}}$$

The coefficient of determination is .453 with the distance elasticity coefficient of 1.403 significant at the 95 percent level with a t-value of 2.41. For the Glenrock model, the model with D_{it} explained much more

of the variance than the other model. Therefore, one can conclude that D_{it} was a significant factor in determination of a worker's residential choice in the Glenrock area.

Rock Springs Model

Data from the Jim Bridger Plant and Mine provided 31 observations for estimating β_i and β_t. The results of the model are as shown:

$$\frac{NL_i}{NL_i} = \frac{POP_i/D_{ij}^{1.179}D_{it}^{.427}}{POP_i/D_{ij}^{1.179}D_{it}^{.427}}$$

The coefficient of determination is .646 with both D_{ij} and D_{it} significant at the 99 percent level with t-values of 7.14 and 2.68, respectively. It is important to note that D_{it} has a positive exponent, which differs from the other models, where the exponent of D_{it} is negative. This follows, since Rock Springs is the only community with a population of over 300 within 40 miles of the Jim Bridger Plant and Mine and also the area's trade center.

The results of the model without D_{it} are as follows:

$$\frac{NL_i}{NL_i} = \frac{POP_i/D_{ij}^{1.022}}{POP_i/D_{ij}^{1.022}}$$

The coefficient of determination is .554 with the distance elasticity coefficient of 1.022 being significant at the 99 percent level with a t-value of 6.01

Summary of the Residential Prediction Models

It is obvious that the quantitative magnitude of the parameters of the residential prediction model vary considerably from area to area. This would indicate that area-specific characteristics, such as adequate housing, community services, etc., have to be taken into account in predicting where nonlocal operating workers will choose to settle.

Estimates of other residential prediction models were made to try to improve reliability. For example, various equations with different combinations of variables were estimated:

$$NL_i = F(POP_i, D_{ij}, D_{it}, POP_i^2, D_{ij}^2, \log POP_i, \log D_{ij})$$

Where: NL_i = nonlocal workers at community i

POP_i = population of community i

D_{ij} = distance between community i and project j

D_{it} = distance between community i and regional trade center t

Equations with POP^2, log POP, D^2, and log D were run to determine if some relationship other than a linear one would improve the reliability of the model. Using the coefficient of determination as a criterion, the models yielded results much inferior to the gravity model concept. A summary of the residential models is included in Table 41 and Table 42.

TABLE 41. SUMMARY REGRESSION RESULTS FOR RESIDENTIAL PREDICTION MODEL WITH β_j AND β_t

Area	β_j	T-ratio	β_t	T-ratio	Observations	R^2
North Dakota	.619	2.56	-1.100	-3.41	21	.648
Glenrock	1.351	4.22	- .851	-4.15	9	.859
Rock Springs	1.179	7.14	.427	2.68	31	.646
Total	1.079	8.08	- .181	-1.61	71	.590

TABLE 42. SUMMARY REGRESSION RESULTS FOR RESIDENTIAL PREDICTION MODEL WITHOUT β_t

Area	β_j	T-ratio	Observations	R^2
North Dakota	.998	3.72	21	.422
Glenrock	1.403	2.41	9	.453
Rock Springs	1.022	6.01	31	.554
Total	1.170	9.64	71	.574

Applicability of the Models

The best way to explain how the model might be used is through the use of a hypothetical situation. Assume that employees are needed for a power plant in an area where there are three communities of varying size within a commuting area (Figure 6). Community C is also considered the regional trade center. There are no other large projects within the commuting region.

Assuming that 200 workers will be required at the power plant, the number of local workers that will be employed from the three communities can be determined using the regional local labor supply model:

		POP		EMP		D		ΣPOP		ΣEMP		WL
LW_a	=1.26	+.0020	(3,000)	+.1551	(200)	-.6324	(20)	-.0007	(20,000)	+.0028	(200)	+.0010 (7,200)
LW_b	=		(2,000)		(200)		(5)		(20,000)		(200)	(7,000)
LW_c	=		(15,000)		(200)		(40)		(20,000)		(200)	(9,000)

LW_a=19 LW_b=27 LW_c=33

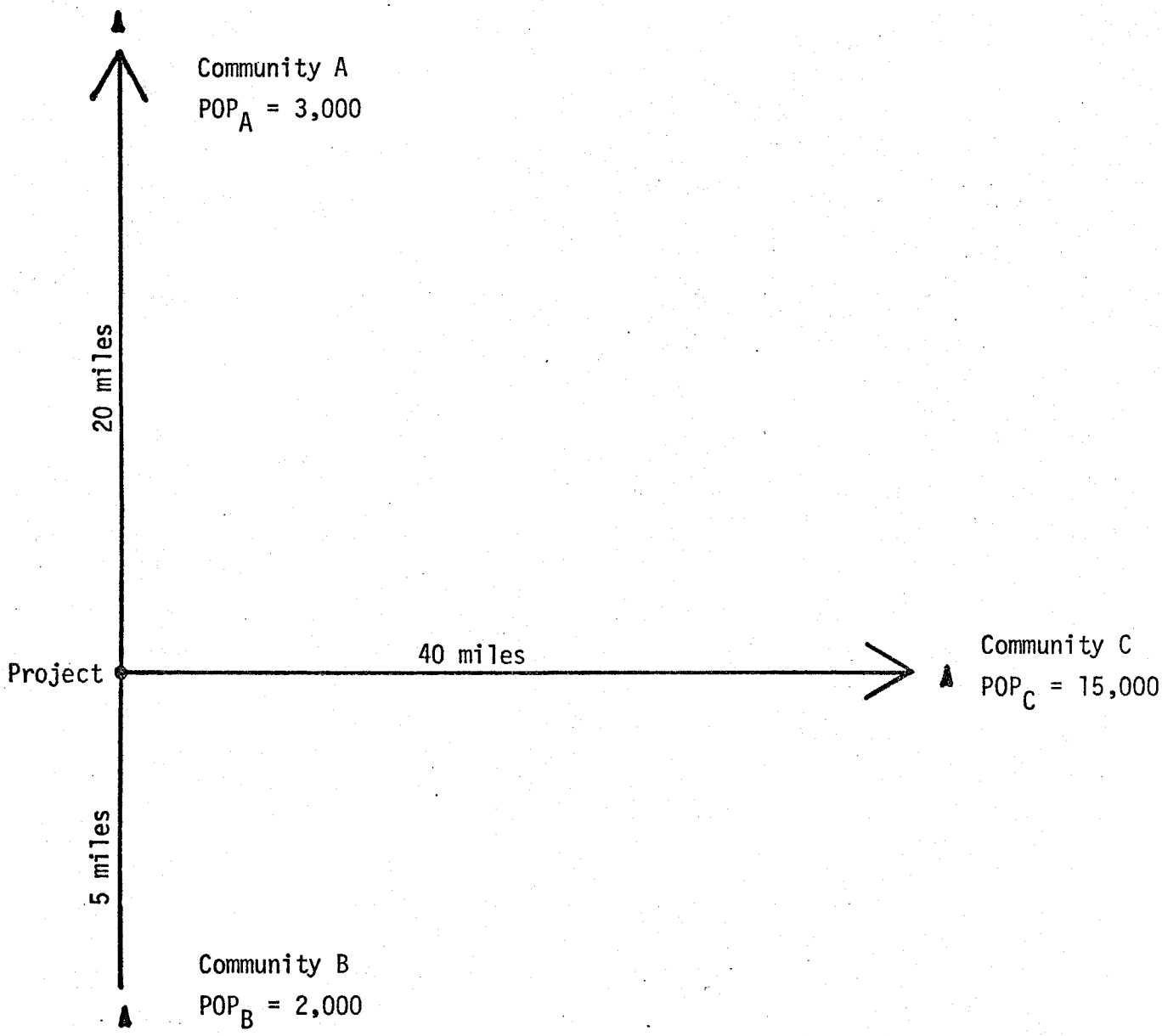

Figure 6. Location of Communities Within Commuting Distance of a Power Plant

The total number of nonlocal workers required can then be determined by subtracting the local workers from the total needed at the power plant. Thus (200)-(79) or 121 nonlocal workers will be required. Using the regional residential prediction model, the residence of the nonlocal workers can be determined:

$$A_a = \frac{3{,}000}{20^{1.019}60^{-.181}} = 297.4$$

$$A_b = \frac{2{,}000}{5^{1.019}45^{-.181}} = 771.9$$

$$A_c = \frac{15{,}000}{40^{1.019}1^{-.181}} = 349.7$$

Summing the A's and using a ratio of each to the total, the following allocation factors can be derived:

Community A	.2096
Community B	.5440
Community C	.2464

Multiplying allocation factors times the 121 nonlocal workers, 25 workers will reside in A, 66 in B, and 30 in C.

Testing of the Residential Prediction Model

The estimates of distance elasticity were tested with actual settlement patterns of the nonlocal workers at the Dave Johnson Power Plant and the nonlocal employees at the three sites located near Stanton, North Dakota. These two sites were chosen because they had several residential choices for the nonlocal workers. The settlement patterns were tested using both regional models (with D_{it} and without D_{it}) and the area models in each case. The models were only tested for communities of over 200 population within the commuting region. The commuting region was confined to within 40 miles of the sites as most of the employees lived within this radius.

The nonlocal employees at the Leland Olds No. 1 Power Plant, United Power's Stanton Plant and the Glenharold Mine were grouped together since all were located near Stanton. The Stanton area is an area where there are several community choices available to nonlocal workers. The North Dakota model that included D_{it} as a variable had less absolute error than the other models (Table 43). A comparison of actual and predicted settlement

patterns with this model indicates that fewer workers settled in Stanton and Beulah and more workers settled in Hazen and Washburn than predicted. This may be a result of Stanton and Beulah not having an adequate supply of housing and housing being available in Hazen and Washburn.

TABLE 43. ACTUAL AND PREDICTED RESIDENCES OF THE NONLOCAL WORKERS AT THE STANTON PLANT, LELAND OLDS NO. 1, AND GLENHAROLD MINE, STANTON, NORTH DAKOTA

Community	Predicted Nonlocal Workers				Actual Nonlocal Workers	Error			
	Regional Model		ND Model			Regional Model		ND Model	
	With D_{it}	Without D_{it}	With D_{it}	Without D_{it}		With D_{it}	Without D_{it}	With D_{it}	Without D_{it}
Stanton	5.9	6.4	3.5	5.8	2	3.9	4.4	1.5	3.8
Hazen	3.0	2.8	3.8	3.0	5	-2.0	-2.2	-1.2	-2.0
Beulah	2.1	1.9	3.6	2.0	1	1.1	.9	2.6	1.0
Center	1.3	1.4	.9	1.5	1	.3	.4	- .1	.5
Washburn	1.2	1.2	.9	1.3	5	-3.8	-3.8	-4.1	-3.7
Underwood	.8	.7	1.0	.8	1	- .2	- .3	0	- .2
Riverdale	.7	.6	1.2	.6	0	.7	.6	1.2	.6
Σ Absolute Errors						12.0	12.6	10.7	11.8

Caution is advised when considering the predictive accuracy of the models. There were only 15 nonlocal workers at the three sites, and the lack of data may prevent accurate analysis.

Comparing the actual versus the predicted residences for workers at the Dave Johnson Power Plant located near Glenrock indicates that again the area model or Glenrock model with D_{it} as a variable had the lowest absolute errors (Table 44). However, it overestimated the number of residents that would settle in Douglas. Again, the availability of housing may have been a major factor in determining residential choice.

Comparison With Old West's Community Choice Model

Mountain West Research used regression analysis similar to that employed in this study to estimate distance elasticity (β_j) for construction workers in a nine-state study area.[23] The value of the distance elasticity

[23]Mountain West Research, Inc., op. cit. The study area included North and South Dakota, Montana, Wyoming, Nebraska, Utah, Colorado, Arizona, and New Mexico.

coefficient (β_j) was .849 with the coefficient of determination .265 and the distance coefficient having a t-ratio of 5.91.

Comparison of these results with the results of the operating residential prediction model in this study (β_j=1.098, coefficient of determination=.500, t-value of 7.68) may indicate that construction workers are willing to commute farther distances than operating workers. However, it should be noted that the samples were not homogeneous in all aspects.

TABLE 44. ACTUAL AND PREDICTED RESIDENCES OF THE NONLOCAL WORKERS FOR THE DAVE JOHNSON POWER PLANT, GLENROCK, WYOMING

Community	Predicted Nonlocal Workers				Actual Nonlocal Workers	Error			
	Regional Model		Glenrock Model			Regional Model		Glenrock Model	
	With D_{it}	Without D_{it}	With D_{it}	Without D_{it}		With D_{it}	Without D_{it}	With D_{it}	Without D_{it}
Glenrock	8.8	6.6	22.0	9.5	34	-25.2	-27.4	-12.0	-24.5
Casper	29.7	34.7	5.6	31.9	9	20.7	25.7	- 3.4	22.9
Douglas	6.2	3.7	18.2	3.8	3	3.2	.7	15.2	.8
Evansville	.9	.8	.5	.8	1	- .1	- .2	.5	- .2
Mills	1.4	1.2	.7	1.0	0	1.4	1.2	.7	1.0
Σ Absolute Errors						50.6	55.2	31.8	49.4

Implications

The prospect of extensive development of Fort Union coal resources has created considerable interest regarding the employment opportunities that will be created and the potential for rapid population growth in rural communities.

One of the objectives of this study was to determine the occupation, education, locational origin, housing preferences, commuting patterns, and other socioeconomic characteristics of operating work forces at electric generating plants and coal mines in North Dakota, South Dakota, Montana, and Wyoming. An understanding of these socioeconomic characteristics may be valuable in helping state and local decision makers plan for expanded coal development.

Another objective of the study was to determine key factors influencing the number of workers that are locally hired (i.e., population, distance, underemployment or wage level, employees at a project, employees

at other projects in the area, and the total population of the area) and to develop a model to predict the local hire rate. While it is obvious that much of the variance in the models remains unexplained, the equations represent a start in determining which variables are important in determining the supply of local workers to major operating sites.

The third objective was to determine key factors influencing the residential choice of the nonlocal workers and to develop a model to predict settlement patterns of the nonlocal workers. Population, distance to the project, and distance to the regional trade center were found to be indicators of a community's attractiveness and were used in the model. The results of the nonlocal models indicate that the magnitude of the parameters varies considerably from area to area. This would indicate that area-specific characteristics, such as adequate housing, community services, etc., have to be taken into account in predicting residential patterns of nonlocal workers. The projection of where the nonlocal workers will settle is probably the most important determinant in assessment of socioeconomic impacts. The number of new and additional services that will be required is directly related to the number of new residents settling in that community. Because of this importance the authors would recommend that further study of socioeconomic impacts of coal development be oriented toward the nonlocal workers. With expanded development throughout the study area, more nonlocal workers will be required. This will require better estimates of settlement and commuting patterns, housing preferences, family composition, and other socioeconomic characteristics associated with the nonlocal workers.

Appendix Table

APPENDIX TABLE 1. LENGTH OF RESIDENCE OF LOCAL AND NONLOCAL COAL INDUSTRY EMPLOYEES IN THEIR PRESENT COMMUNITY BY TYPE OF HOUSING, NORTH DAKOTA, 1974[a]

Type of Housing	Less Than 1 Year		1-5 Years		6-10 Year		11-20 Years		Over 20 Years		Total	
	Number	Percent of Row Total	Number	Percent of Row Total	Number	Percent of Row Total	Number	Percent of Row Total	Number	Percent of Row Total	Number	Percent of Row Total
						LOCAL						
Own House	0	0.0	3	2.1	25	17.9	19	13.6	93	66.4	140	74.1
Own Mobile Home	0	0.0	5	18.5	1	3.7	5	18.5	16	59.3	27	14.3
Own Other	0	0.0	0	0.0	0	0.0	1	33.3	2	66.7	3	1.6
Rent Apartment	1	25.0	0	0.0	1	25.0	0	0.0	2	50.0	4	2.1
Rent House	0	0.0	1	7.1	6	42.9	2	14.3	5	35.7	14	7.4
Rent Mobile Home	0	0.0	0	0.0	0	0.0	0	0.0	1	100.0	1	0.5
TOTAL	1	0.5	9	4.8	33	17.5	27	14.3	119	63.0	189	100.0
						NONLOCAL						
Own House	5	33.3	10	66.7	0	0.0	0	0.0	0	0.0	15	36.6
Own Mobile Home	6	85.7	1	14.3	0	0.0	0	0.0	0	0.0	7	17.1
Own Other	2	66.7	1	33.3	0	0.0	0	0.0	0	0.0	3	7.3
Rent Apartment	6	85.7	1	14.3	0	0.0	0	0.0	0	0.0	7	17.1
Rent House	6	85.7	1	14.3	0	0.0	0	0.0	0	0.0	7	17.1
Rent Mobile Home	1	100.0	0	0.0	0	0.0	0	0.0	0	0.0	1	2.4
Rent Other	1	100.0	0	0.0	0	0.0	0	0.0	0	0.0	1	2.4
TOTAL	27	65.9	14	34.1	0	0.0	0	0.0	0	0.0	41	100.0

[a]Nine local and two nonlocal employees did not answer one of the two questions.

Appendix A

NORTH DAKOTA ELECTRIC POWER PLANT AND COAL MINE WORK FORCE QUESTIONNAIRE

Electric Power Plant and Coal
Mine Work Force Questionnaire

DO NOT WRITE YOUR NAME ON THIS QUESTIONNAIRE. YOUR RESPONSES WILL REMAIN ANONYMOUS.

Directions: Please read and answer each of the following questions with the answer which best describes your situation. Fill in the blank or check the appropriate response.

1. Name of power plant or coal mine at which you work _____

2. Name of county in which you live _____

3. Sex: ____Male ____Female

4. Your age: _____Years

5. Race: ____White ____Negro ____Other
   ____Indian ____Spanish American

6. Marital status: ____Married ____Separated ____Never married
   ____Divorced ____Widowed

7. Number of children living at home: _____

8. Where were you born?
   ____North Dakota
   ____Out of state
   ____Foreign country

9. Where do you live?
   ____On a farm. If a farm, how many acres? _____Acres
   ____Outside the city limits, but not on a farm
   ____In a city under 500 population
   ____In a city between 500-1,000 population
   ____In a city between 1,000-2,500 population
   ____In a city between 2,500-5,000 population
   ____In a city between 5,000-10,000 population
   ____In a city over 10,000 population

10. How long have you lived in this community? _____Years

11. How long have you lived at your present address?
    ____Under 1 year ____5-10 years
    ____1-3 years ____Over 10 years
    ____4-5 years

12. Do you own or rent a home?

	Own	Rent
House	____	____
Apartment	____	____
Trailer home	____	____
Condominium or town house	____	____
Other	____	____

13. From where did you move to this community?
    ____Never have moved
    ____Within the county you now reside
    ____From another North Dakota county. Name of county _____
    ____Out of state. Name of state _____
    ____Foreign country. Name of foreign country _____
    ____Other

14. Formal education (exclude vocational training beyond high school):
    ____8 years or less ____13-15 years
    ____9-11 years ____16 or more years
    ____12 years

15. Vocational training (months):
    ____6 or less months ____25 or more months
    ____7-12 months ____Time unknown
    ____13-18 months ____No vocational training
    ____19-24 months

16. Type of vocational training, if any _____

NOW WE WOULD LIKE TO ASK SOME QUESTIONS ABOUT YOUR PRESENT EMPLOYMENT.

17. Job title of your present job _____

18. Have you held more than one position with the company you are currently working for? ____Yes. If yes, how many positions? _____

____No

19. How long have you worked with the company by which you are presently employed? _____Years

20. Have you been unemployed at any time during the past 12 months?

____Yes ____No

21. Yearly earnings at your present job:

____Less than $5,000	____$10,000-$10,999	____$16,000-$16,999
____$5,000-$5,999	____$11,000-$11,999	____$17,000-$17,999
____$6,000-$6,999	____$12,000-$12,999	____$18,000-$18,999
____$7,000-$7,999	____$13,000-$13,999	____$19,000-$19,999
____$8,000-$8,999	____$14,000-$14,999	____Over $20,000
____$9,000-$9,999	____$15,000-$15,999	

22. How far do you travel (one-way) to get to work? _____Miles

23. By what means of transportation do you travel to work?

____Privately owned car	____Walk
____Car pool	____Other
____Public transportation	

24. How satisfied are you with your present job?

____Very satisfied

____Satisfied

____So-so

____Unsatisfied

____Very unsatisfied

THE NEXT FEW QUESTIONS CONCERN YOUR LAST EMPLOYMENT BEFORE WORKING FOR YOUR PRESENT EMPLOYER.

25. ____I have never worked for another employer

26. Name of company where you were last employed _____

27. Job title of your last job _____

28. Location of work:

____Within same county you now reside

____In another North Dakota county

____In another state

____Other

29. Total years of employment with previous employer? _____Years

30. How far did you travel to work in your last job? _____Miles

31. Reason for leaving your past employment _____

_____

32. Yearly earnings of last job at time of leaving:

____Less than $5,000	____$10,000-$10,999	____$16,000-$16,999
____$5,000-$5,999	____$11,000-$11,999	____$17,000-$17,999
____$6,000-$6,999	____$12,000-$12,999	____$18,000-$18,999
____$7,000-$7,999	____$13,000-$13,999	____$19,000-$19,999
____$8,000-$8,999	____$14,000-$14,999	____Over $20,000
____$9,000-$9,999	____$15,000-$15,999	

33. What was the difference between your yearly earnings at your last job and your starting salary with your present energy-related company?

$_____

Appendix B

BIG STONE PLANT WORK FORCE QUESTIONNAIRE

BIG STONE PLANT
WORK FORCE QUESTIONNAIRE

What is your occupation (job title, be specific)_____

What is your local address_____ _____
Street Town

(If rural give distance and directions from nearest town)

Are you living in the same town you lived in before you started working on this job? Yes_____ No_____

If no, where did you live previously? _____ _____
Town State

Are you married or single? (Circle one)

Married Single Widowed Divorced

If single, skip to question 8.

We would like to know a few things about your family, if you have one. (Check one).

_____ I have a family that lives with me in this community.

_____ I have a family, but they're not living with me in this community.

Please indicate how many children you have in each of the following categories.

School category	No. of children	State the number of children en each school cateogry which are living with you in this community.	Indiacte the city which children will be attending school this fall.
Preschool Elementary(1-8) Secondary(9-12) College			

If your family is not living with you now,

a. Where are they living now? _____ _____
Town State

b. Did they live there before you started work on this job?

Yes_____ No_____

c. If no, where did they live: _____ _____
Town State

8. What is the last year of school you completed?
_____some elementary _____vocational training
_____completed 8th grade _____some college
_____some high school _____completed college (B.A. or B.S.)
_____completed high school _____professional education (post-B.A.)

9. Have you received "on the job training?" _____Yes _____No

a. If yes, what type of "on the job training?"_____

10. If you received voactional training at a school, what type of vocational training did you receive?_____
How long did you attend vocational training school?_____months

NOW WE WOULD LIKE TO ASK SOME QUESTIONS ABOUT YOUR PRESENT EMPLOYMENT.

11. Have you held more than one position with the company you are currently working for? _____Yes If yes, how many positions?_____ (Do not include present on
_____No

12. How long have you worked with the company by which you are presently employed?
_____years

13. How long have you been working in this area? _____years _____months

14. Have you been unemployed at any time during the past 12 months? Yes____ No

15. Yearly earnings at your present job: (before taxes)

_____Less than $5,000 ____$10,000-10,999 _____$16,000-16,999
_____$5,000-5,999 ____$11,000-11,999 _____$17,000-17,999
_____$5,000-6,999 ____$12,000-12,999 _____$18,000-18,999
_____$7,000-7,999 ____$13,000-13,999 _____$19,000-19,999
_____$8,000-8,999 ____$14,000-14,999 _____$Over $20,000
_____$9,000-9,999

16. How far do you travel (one-way) to get to work? _____Miles

17. By what means of transportation do you travel to work?

_____Privately owned car _____Walk
_____Car pool _____Other
_____Public transportation

18. How satisfied are you with your present job?

_____Very satisifed
_____Satisified
_____So-so
_____Unsatisfied
_____Very unsatisfied

HE NEXT FEW QUESTIONS CONCERN YOUR LAST EMPLOYMENT BEFORE WORKING FOR YOUR RESENT EMPLOYER.

9. _____I have never worked for another employer.

0. Name of company where you were last employed_____

1. Job title of your last job_)_____

2. Location of work:

_____Within same county you now reside
_____In another North Dakota county.
_____In another state
_____Other

3. Total years of employment with your previous employer?_____Years

4. How far did you travel to work in your last job?_____Miles

5. Reason for leaving your past employment._____

6. Yearly earnings of last job at time of leaving:

_____Less than $5,000	_____$10,000-10,999	_____$16,000-16,999
_____$5,000-5,999	_____$11,000-11,999	_____$17,000-17,999
_____$6,000-6,999	_____$12,000-12,999	_____$18,000-18,999
_____$7,000-7,999	_____$13,000-13,999	_____$19,000-19,999
_____$5,000-8,999	_____$14,000-14,999	_____$20,000 and over
_____$9,000-9,999	_____$15,000-15,999	

What was the difference between your yearly earnings at your last job and your starint salary with your present employer?

$_____more/year $_____less/year $_____no difference

7. Where do you live?

On a farm._____ (If a farm in what county)_____
Outside the city limits, but not on a farm._____ (County)_____
In a town or city._____ (City)_____

8. How long have you lived in this community? _____Years

9. Do you own or rent a home?

	Own	Rent
House	_____	_____
Apartment	_____	_____
Trailer home	_____	_____
Condominium or town house	_____	_____
Other	_____	_____

30. With regard to your future housing plans, within the next year, are you planning to:

_____continue living in your present housing
_____buy a house
_____build a house
_____buy a trailer
_____rent an apartment
_____other

31. We would like to know if you receive the following services in the community in which you live and your satisfaction with them.

	In which town do you obtain most of the following services or items	How satisfied are you with each of the following services or items		
		Satisfied	So-so	Unsatisfied
Medical services				
Clothing				
Food				
Financila (banking)				

32. Compared to other places you've lived, how do you rate the community services in this area?
_____very good services
_____adequate services
_____inadequate services

33. What groups or organizations do you belong in this community? (i.e., school board, civic clubs, etc.)_____

Are you intersted in holding an office in any of these organizations?

_____yes, I am interested
_____yes, I hold an office
_____no, I am not interested

34. If the opportunity presented itself, would you like to continue living in this community? Yes_____ No_____ Don't know_____

ANSWER THE FOLLOWING TWO QUESTIONS ONLY IF YOU HAVE LIVED IN THIS COMMUNITY LESS THAN 3 YEARS !!!

35. What group of people do you associate with most socially?
plant co-workers_____
other newcomers to this community_____
old time community members_____

36. Generally, speaking, are you more or less satisfied with your present community then with the one where you lived previously?

_____more
_____less
_____no different

ANSWER THE FOLLOWING TWO QUESTIONS ONLY IF YOU HAVE LIVED IN THIS COMMUNITY MORE THAN 3 YEARS.

37. What group of people do you associate with most socially?

_____plant co-workers
_____newcomers to this community
_____old time community members

38. Would you say that the quality of life here is improving, going downhill, or staying about the same?

_____improving
_____downhill
_____stay the same

39. Are you _____male _____female

40. What is your age? _____years

41. Do you have a religious affiliation? Yes_____ If yes, what_____
No_____

42. What is your race?

_____white _____Negro
_____Indian _____Spanish American
_____other, please specify_____

43. Where were you born? (state, county if not in United States)

_____

THANK YOU FOR YOUR COOPERATION!!

Appendix C

WYOMING WORK FORCE QUESTIONNAIRE

A STUDY OF THE SOCIAL AND ECONOMIC NEEDS
OF PEOPLE EMPLOYED IN THE OPERATION AND
MAINTENANCE OF ELECTRIC POWER GENERATING PLANTS

Dear Respondent:

The Department of Sociology at the University of Wyoming is cooperating in a three-state study of the needs and desires of people employed in the operation and maintenance of electric power generating plants and related mines. In order to help Wyoming communities to better plan for growth as more power plants are built in the state, we are asking that you answer the following questions as accurately as possible.

All replies will be kept confidential, no person or address will be identified with a specific statement or position. Completed questionnaires will be mailed directly to the University of Wyoming by you and will be seen only by the researcher on this project. Your responses will be coded and placed on IBM cards for computer analysis. A final report summarizing all responses will be made available to all interested parties.

1. What is your occupation (job title, be specific)?_____

2. In what town do you live?_____
Town

IF YOU DO NOT LIVE IN TOWN, give distance (one-way)_____from nearest town. Name of nearest town_____.

3. Is your local address in the same town as it was before you started working on this job? _____Yes _____No

4. How long have you worked with the company by which you are presently employed? _____Year(s) _____Month(s)

5. Have you held more than one position with the company you are currently working for? _____Yes If yes, how many positions?____(do not include current position)
_____No

6. Did you work for this company at another location? _____Yes _____No

7. What are your hourly earnings at your present job?_____
If paid monthly, what are your monthly earnings?_____

8. How long have you lived in this community?_____Year(s)_____Month(s)

9. Would you like to continue living in this community? ___Yes ___No
___Do not know

10. How many miles (one-way) do you commute to work each day?_____

11. Are you satisfied with commuting this distance?___Yes, the distance is reasonable ___No, the distance is too great

12. How do you usually travel to work? (check only one) ___private car ___car pool ___walk ___public transportation ___other, specify_____

13. Please indicate the job title of the last job that you had before working at this plant or mine site, where it was, and how long you were employed.

Job Title	City and State	Length Employed

(over)

14. What was the difference between your monthly earnings at your last job and your starting salary with your present employer?

$_____more/month/ $_____less/month/ _____no difference

15. Are you: _____male _____female

16. What is your age?_____

17. Where were you born? (List country only if not born in U.S.)

State_____ Country_____

18. How many years of schooling have you completed? _____

19. What is your marital status? (circle one) Married Single Widowed Divorced

IF YOU DO NOT HAVE A WIFE OR A FAMILY, PLEASE DO NOT ANSWER THE NEXT THREE QUESTIONS.

20. How many children under 18 do you have?_____ children

21. Please indicate the sex and age for each of your children.

	sex (circle one)		age
1	M	F	___
2	M	F	___
3	M	F	___
4	M	F	___
5	M	F	___

22. Is your spouse living with you at your local address? Yes____ No____
If your spouse is NOT living with you at your local address, where is your spouse living? Town_____ State_____

23. In what type of housing do you presently live? (check the appropriate answer)

	Own	Rent
apartment	___	___
single family housing	___	___
mobile home	___	___
other _____	___	___

24. How long have you lived in your present home? _____

25. If you had your choice, would you prefer to live in some other form of dwelling unit than you are presently occupying?

( ) 1. yes (please specify)
( ) 2. no

26. Please list any changes you would like to see made in this community to make it a more satisfying place for you to live.

1. _____
2. _____
3. _____

27. In the spaces below write in the five (5) recreation activities you and your family engage in the most.

1. _____
2. _____
3. _____
4. _____
5. _____

Appendix D

DECKER COAL MINE QUESTIONNAIRE

EMPLOYEE QUESTIONNAIRE

1) CHECK ONE: _____ Male _____ Female

2) MARITAL STATUS:
_____ Married _____ Single _____ Divorced _____ Widowed

3) AGE:
_____ 18-25 _____ 26-35 _____ 36-45 _____ 46 and over

4) WHAT IS THE LAST GRADE YOU COMPLETED IN SCHOOL?
_____ 8th grade _____ 4 years college
_____ 12th grade _____ over 4 years college
_____ 2 years college _____ vocational/technical school

5) LENGTH OF SERVICE WITH PKS AND AFFILIATES:
___ 0-6 months ___ 6 months-1 year ___ 1-2 years ___ 2-5 years ___ 5 years/over

6) PRESENT JOB:
_____ Craft _____ Supervisory _____ Technical _____ Clerical

7) EMPLOYER:
_____ District _____ Big Horn Coal _____ Decker Coal

8) SPOUSE EMPLOYED: _____ Yes _____ No

9) NUMBER IN HOUSEHOLD:
___ 1 ___ 2 ___ 3 ___ 4 ___ 5 ___ 6 ___ 7 ___ 8 ___ 9 and over

10) BASED ON CURRENT EARNINGS, WHAT IS YOUR ESTIMATED TOTAL FAMILY INCOME, BEFORE TAXES, IN 1975.
_____ Less than $5,000 _____ $15,000-$19,999
_____ $5,000-$9,999 _____ $20,000-$24,999
_____ $10,000-$14,999 _____ $25,000 and over

11) WHAT IS YOUR CURRENT AVERAGE WEEKLY KIEWIT INCOME? _____

12) NUMBER OF DEPENDENTS IN SCHOOL:
_____ Grade school _____ Local college
_____ Jr. high school _____ College out of area
_____ High school

13) NUMBER OF VEHICLES IN HOUSEHOLD:
_____ Automobiles _____ Camp trailers
_____ Trucks _____ Boats
_____ Truck campers _____ Motorcycles

14) DO YOU OWN OR RENT YOUR PRESENT DWELLING?

	OWN	RENT
a) Single family house	____	____
b) Apartment	____	____
c) Condominium/townhouse	____	____
d) Mobile home		
Single	____	____
Double	____	____

e) Other (Please specify)
_____

15) PRESENT HOME LOCATION:
_____ Sheridan _____ Wyoming rural
_____ Montana _____ Other Wyoming town
Where? _____

16) BIRTHPLACE (Check one):
_____ Sheridan County _____ Montana
_____ Wyoming _____ Elsewhere

17) IF YOU WERE NOT BORN IN OR NEAR THIS AREA, IN WHAT YEAR DID YOU MOVE HERE? _____

18) DID YOU MOVE HERE TO WORK FOR PKS OR AFFILIATES?
_____ Yes _____ No

19) DO YOU FIND YOUR PRESENT DWELLING THE MOST DESIRABLE TYPE OF HOUSING, OR WOULD YOU PREFER TO BE LIVING IN ANOTHER TYPE OF HOUSING?
Present type satisfactory: _____
Different type more desirable: _____

20) IF YOU WOULD PREFER ANOTHER TYPE OF HOUSING, WHAT ARE YOUR PREFERENCES?

a) Single family house	OWN	RENT
b) Apartment	OWN	RENT
c) Condominium/townhouse	OWN	RENT
d) Mobile home	OWN	RENT

e) Other (Please specify) _____

21) IF YOU WOULD PREFER ANOTHER TYPE OF HOUSING, WHAT HAS PREVENTED YOU FROM MAKING THAT CHANGE?
Check as many as apply:
_____ Cannot get loan:
_____ Interest rate too high
_____ No down payment
_____ Income too low
_____ Unavailability:
_____ Of old housing
_____ Of new housing
_____ Of land
_____ Cannot afford it
_____ Other (Please specify) _____

List of Tables

APPENDIX TABLE

List of Figures