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Impacts of Energy Development on Secondary Labor Markets: A Study of Seven Western Counties

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PREFACE

Energy and resource development in the Western United States has resulted in rapid and substantial growth in many rural counties. This growth has created new opportunities for employment and expansion of area tax bases, as well as demands for additional housing, public services, and educational facilities. In addition, demands for increased goods and services from the private sector result in expansion of existing businesses, attraction of new firms to the area, and a substantial number of new jobs created in these secondary sectors.

The origin of these secondary workers is important to impact management efforts. If these workers were area residents previously unemployed, little immigration will occur. Conversely, if insufficient local labor is available, substantial immigration of workers and their dependents can be expected.

This study attempts to determine key characteristics of these secondary workers in seven counties of four states, and the implications that the results of these surveys have on planning for socioeconomic impact management.

In conducting this survey, the authors wish to extend their thanks to Don Albrecht, Department of Rural Sociology, Texas A&M University, and Stan Albrecht, Department of Sociology, Brigham Young University, for assistance in conducting the survey in Texas, Utah, and Wyoming, and to Delores Zieman, for conducting the North Dakota interviews. Most of all, we wish to thank the business owners, employees, and chambers of commerce in all seven counties, without whose cooperation and support this survey would not have been possible.

Within the Department of Agricultural Economics, numerous faculty members provided valuable reviews and comments which have improved the manuscript. Finally, we express our appreciation to Carlena Vocke, Lori Cullen, Harvey and Sharon Vreugdenhil, Carol VavRosky, and Brenda Ekstrom for statistical support and manuscript preparation.

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Highlights

Energy and resource development in rural areas is often accompanied by a variety of impacts on areal economic and social structures. While pubilc services, education, fiscal impacts, and direct employment effects have been studied and documented, little research has been done regarding development impacts on private sector providers of goods and services. Origin and characteristics of these secondary business employees can have substantial bearing on the overall project impact if a large percentage inmigrate to the area with their families.

This study documents the results of a four-state survey conducted to identify characteristics of secondary businesses and their employees. The survey, conducted by North Dakota State University with the assistance of Texas A&M University and Brigham Young University, covered seven counties in North Dakota, Texas, Utah, and Wyoming. Six of these have experienced energy development in the last 10 years, while the seventh was a control set.

Results indicate that most businesses in counties experiencing energy development expand either inventory or floor space to capitalize on increased demands for goods and services. In addition, high percentages of the businesses surveyed were established in the years since energy development in the county began. Although business owners had to increase wages paid and experienced some difficulty attracting and retaining new employees, these were not as great a problem as anticipated.

About one employee in four had a spouse employed at one of the area's energy facilities. Inmigrants accounted for more than 75 percent of the sample of energy-impacted counties.

IMPACTS OF ENERGY DEVELOPMENT ON SECONDARY LABOR MARKETS: A STUDY OF SEVEN WESTERN COUNTIES

John M. Halstead and F. Larry Leistritz*

The past decade has seen vastly accelerated development of western coal, oil, gas, and uranium reserves to accommodate national energy demands. Exploitation of these resources has resulted in increasing numbers of large-scale projects being sited in sparsely populated areas. Consequently, many small rural communities with histories of stable or declining population and business activity have had to cope with rapidly increasing populations and demands for community services (Murdock and Leistritz, 1979; Gilmore and Duff, 1975).

Much of this growth is desired by local officials and residents, since these large-scale projects often result in an expanded economic base, employment opportunities, and additional tax revenues. This rapid growth in population and service needs can also pose substantial management and financial problems. Negative impacts which may arise as a consequence of this growth include strains on the economic, fiscal, public service, and housing sectors of the local community and changes in the area's social and demographic structures (Halstead et al., 1982). A town or community is most likely to experience such negative effects of development when an annual growth rate of 5 to 10 percent or greater occurs (Gilmore, 1975; FEA, 1977).

The socioeconomic effects of resource development have received increased attention from decisionmakers in recent years, and numerous analyses and case studies dealing with the subject have been published (Leistritz et al., 1982; Gilmore et al., 1981; Halstead and Leistritz, 1983). The National Environmental Policy Act (NEPA) mandated that developers conduct an assessment of the socioeconomic impacts of their projects, while several states have imposed regulations governing impact assessment and management for major projects (e.g., Wyoming Industrial Development and Siting Act, 1975; North Dakota Energy Facility Siting Act, 1975). In some states, such as Colorado, county governments have required certain impact mitigation measures as conditions for granting construction and operation permits.

These legal initiatives, coupled with industry's concern for maintaining balanced growth and favorable living conditions for its workers, have resulted in various management measures, such as housing provision, upgrading and expansion of public services and infrastructure, and community planning assistance. Preliminary impact assessments are performed which incorporate such data as project construction and operation work force size and estimated immigration of workers and family members. Effects on area fiscal, public service, housing, and other sectors are then estimated. An impact management plan is then formulated to eliminate, reduce, or mitigate these impacts. One of the keys to a successful impact management plan is a monitoring program which provides accurate and timely socioeconomic information for decisionmakers. These monitoring programs provide information

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on variables such as worker origin, residence, and occupation, as well as on community indicators such as population, health care, housing, and school enrollments (Leistritz and Chase, 1982). These data are invaluable in evaluating and reformulating impact management plans.

One of the accompanying features of the large population influxes often experienced by energy development communities is an increase in demands for goods and services in the private sector. Construction and operation workers and their families may demand retail goods and services in greater quantity and variety than local merchants had been accustomed to supplying, thereby spurring expansion of existing firms and attracting new firms to the area.

Gilmore et al. (1981) in a study of nine development sites, found that each construction job at an energy facility generated between .2 and .7 jobs in the local service sector. This multiplier may be even higher for operational jobs after project construction. It can be concluded that the secondary business and public service sectors provide a significant source of employment. Although the monitoring plans previously mentioned provide information on the primary energy jobs, few attempts have been made to measure the behavior and impacts of the secondary business sector and its employees on energy development communities. Similarly, few attempts have been made to isolate characteristics of public sector employees in these communities. If these secondary jobs are filled by previously unemployed local residents or dependents of inmigrating project workers, inmigration to the community (and additional demands on housing and services) will be reduced. If these jobs are not filled by locals, additional workers and their dependents may move to the area. The source and socioeconomic characteristics (such as previous residence and family size) of these workers is therefore important to planners and community officials dealing with rapid growth.

It has also been speculated that high wages offered at energy developments may lure workers away from local businesses and force owners to pay higher wages to attract qualified employees. On the positive side, increased economic activity was thought to lead to expansion of existing firms and attraction of new firms to the area.

Objectives

This study is based upon a survey of secondary business and public sector employers and employees in six western U.S. counties affected by energy development. In addition, data from a seventh county which has experienced no energy development were added as a control.

Specific objectives of this report are to

1. Identify difficulties experienced by secondary business owners in attracting qualified workers and determine the extent to which floor space and inventory were expanded to accommodate the community's rapid growth

2. Identify characteristics of secondary business workers, especially family size, previous residence, and relationship (if any) to workers at the energy facilities

3. Identify and analyze factors which influence wages earned by secondary business workers

4. Identify characteristics of employees in public sector occupations such as education, law enforcement, and health care, and compare these with employee characteristics in the private sector

5. Evaluate implications of these findings and possible planning measures which might apply

Study Areas

As noted previously, seven counties in the western U.S. were chosen for this survey (see Table 1). These counties were selected to provide a cross

TABLE 1. CHARACTERISTICS OF WESTERN COUNTIES SURVEYED

County/State	1970 Population	1980 Population	Development Impact	Peak Work Force (Year)
Emery/Utah	5,137	11,455	Power Plants Coal Mining	1,605 (1978)
Fayette/Texas	17,650	18,832	Power Plant	867 (1978)
Hettinger/North Dakota	5,075	4,275	(Control)	NA
McLean/North Dakota	11,251	12,288	Power Plant	2,224 (1978)
Mercer/North Dakota	6,175	9,404	Power Plant, Coal Gasification	5,764 (1983)
Panola/Texas	15,894	20,724	Power Plant	1,600 (1979)
Uinta/Wyoming	7,100	13,021	Gas Processing Plants Oil & Gas Development	7,500 (1982)

SOURCES: U.S. Department of Commerce, Bureau of the Census (1982); Texas Utilities (1982); Murdock et al (1981); Prall, 1983; ITAT (1983); Leistritz and Maki (1981).

section of development scenarios. Two counties had experienced construction of a power plant several years ago, so that project-related growth had subsided; three are currently undergoing energy development-related expansion; one county expanded due to a power project and currently has a substantial number of

operating employees at the plant and mine; and one rural, sparsely settled county which has undergone no major developments in the past 10 years was chosen as a control. A brief description of each county follows.

Emery County, Utah, is the site of five completed or under-construction coal-fired power plants (Figure 1). Construction on the first unit began in 1971, with the fifth due for completion in 1983. In addition, the county has experienced rapid development of its coal reserves in the past decade. However, with the recent downturn in energy demand and the winding down of construction on the power plants, the county has experienced a decline in economic activity. This situation has been made worse by mudslides in the spring of 1983 which severed rail access to the county for several months and prevented shipment of much of the coal still being mined (Prall, 1983). The survey was conducted in the towns of Huntington and Castle Dale.

Fayette County, Texas, was also the site of a coal-fired power plant (Figure 2a). The two-unit plant, located near the cities of Fayetteville and La Grange, came on line in 1980, with a total generating capacity of 1,200 megawatts (MW). The survey was conducted in the county's largest town, La Grange.

Hettinger County, North Dakota, was chosen as the control for the study (Figure 3). The county, which actually experienced a population decline between 1970 and 1980, was judged to be representative of many rural western counties experiencing no energy development and stable or declining growth. Surveys were conducted in the cities of Mott and New England.

McLean County, North Dakota, was affected by construction of the Coal Creek coal-fired power plant between 1975 and 1980. The survey was undertaken in the two towns most impacted by the development, Washburn and Underwood.

Mercer County, North Dakota, has been principally affected by three major energy developments: the Coyote Generating Station, completed in 1981; the Great Plains Coal Gasification Plant, scheduled for completion in the late 1980s; and the Antelope Valley Power Station, slated for completion in 1985. The towns surveyed were Beulah and Hazen.

The second Texas area surveyed was Panola County (Figure 2b). This county was impacted by construction of three 750 MW coal-fired power plant units between 1973 and 1979. The utility continues to employ about 1,900 workers at the plants and mines. Interviews were conducted in the towns of Tatum and Beckville.

The final county surveyed was Uinta, in Wyoming (Figure 4). In the West's Overthrust Belt, the county has been the site of extensive gas and oil development, as well as construction of several gas-processing plants. Surveys were taken of businesses in the town of Evanston, the county's principal city.

Methodology

Data were obtained from three surveys conducted in each study county: an employer, employee, and public sector survey. The surveys were conducted

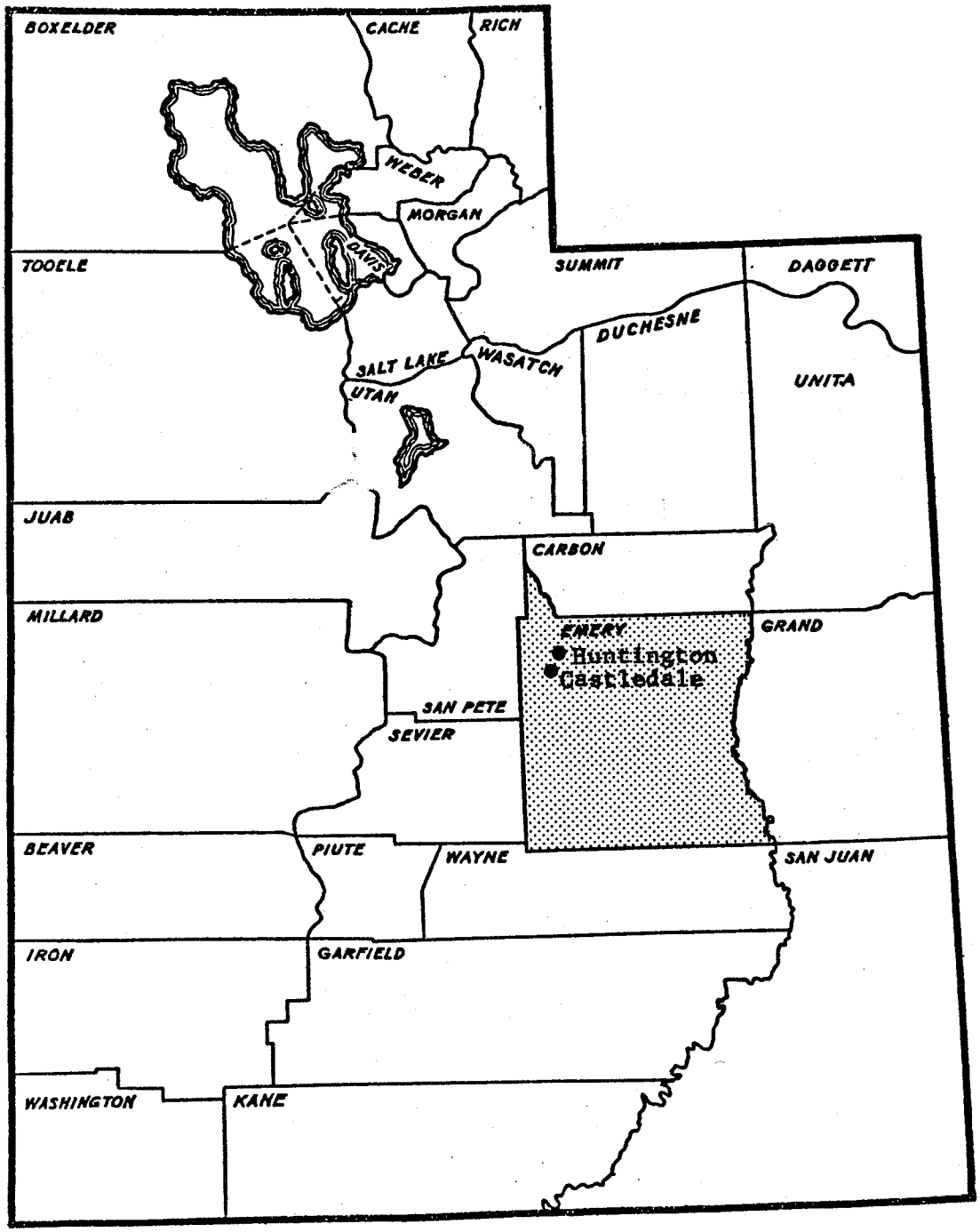

Figure 1. Study Areas in Utah

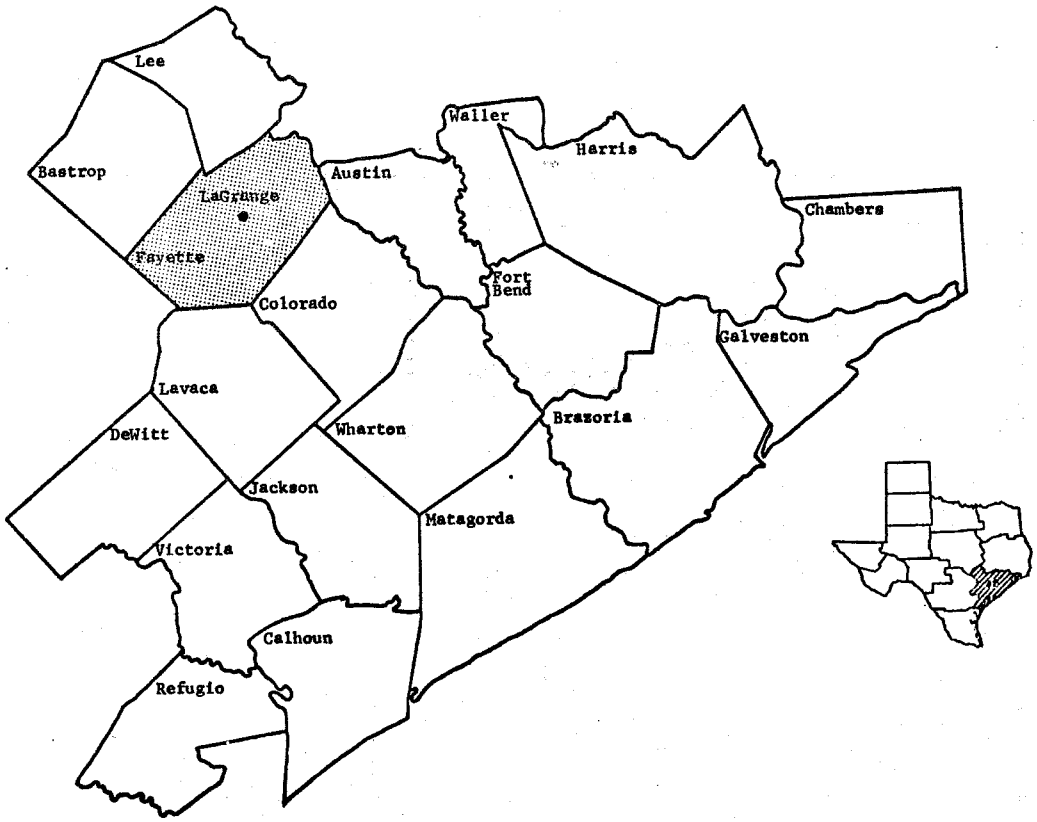

Figure 2a. Study Areas in Texas

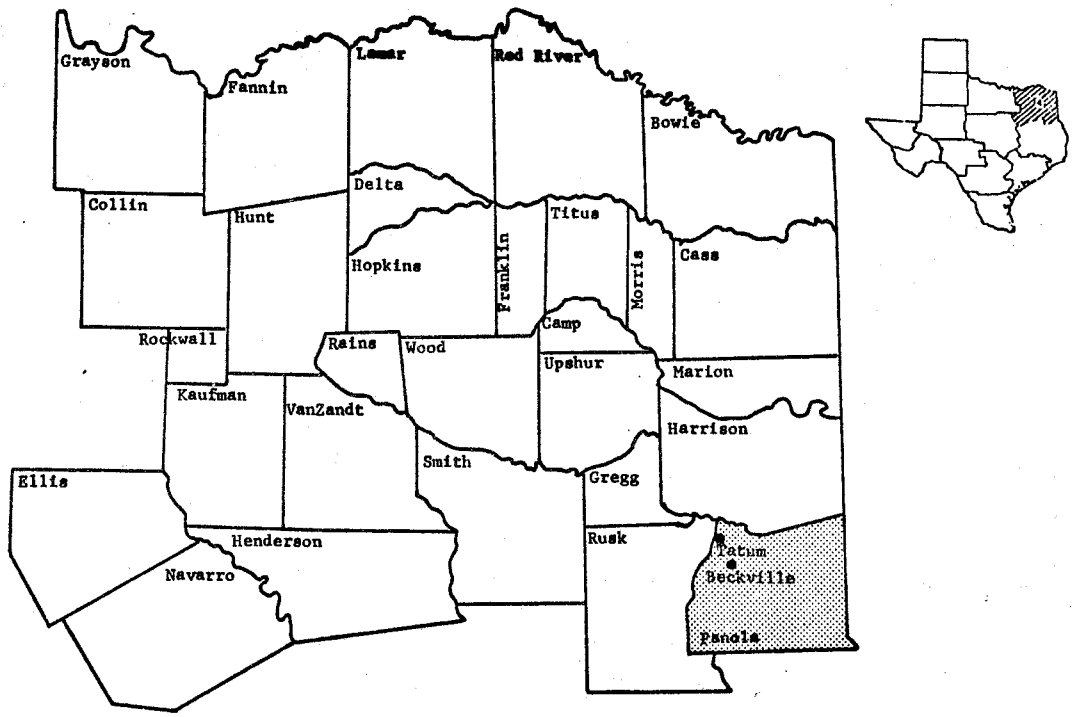

Figure 2b. Study Areas in Texas

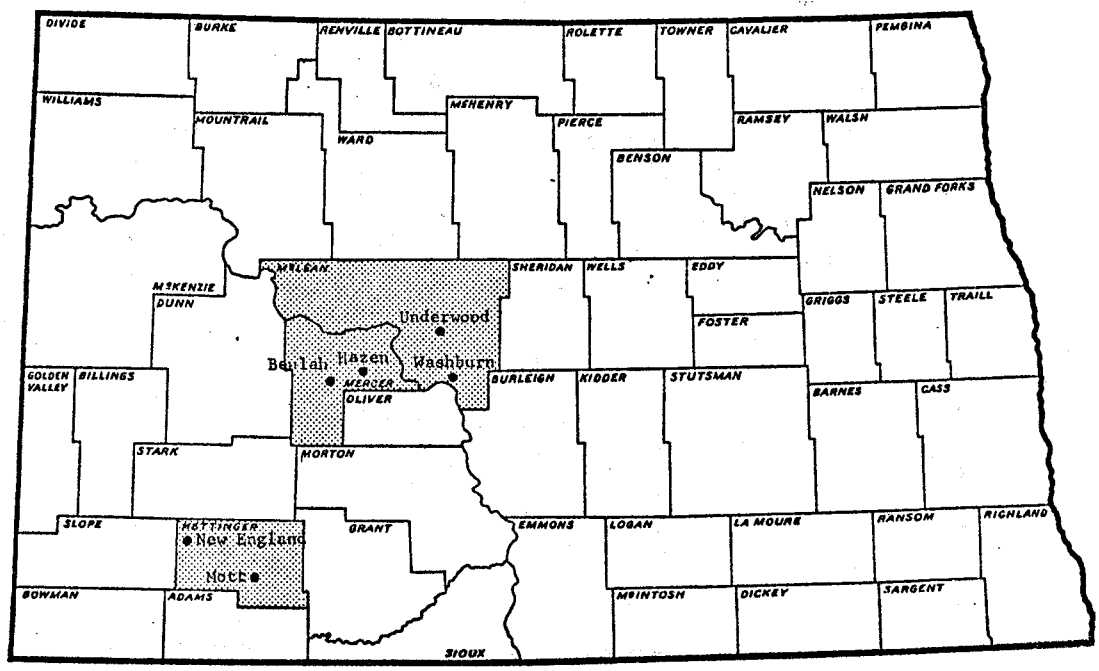

Figure 3. Study Areas in North Dakota

in fall and winter, 1982-83. The employer survey was conducted by personal interview with local business owners and managers. These businessmen were then given employee surveys for distribution to their employees, who returned them for pick up or mailed them to the interviewer with a stamped envelope which the interviewer provided. Public sector employee questionnaires were distributed in conjunction with a survey of community leaders in the six energy counties and collected via interviewer pickup or return envelope.

Surveys in McLean, Mercer, and Hettinger counties were conducted by North Dakota State University. The surveyor attempted to contact all town businesses, using lists obtained from area chambers of commerce. Response rates for employee surveys were 61.6 percent (Hettinger), 55.5 percent (Mercer), and 52.0 percent (McLean). Employer response rates were 97.5 percent (Hettinger), 93.3 percent (McLean), and 84.7 percent (Mercer).

Surveys in Emery and Uinta counties were conducted by Brigham Young University. The business survey attempted to draw a representative cross section of area commerce from County Business Pattern data. No response rates were kept for business surveys; employee survey response rates were 100.0 percent (Emery) and 88.9 percent (Uinta).

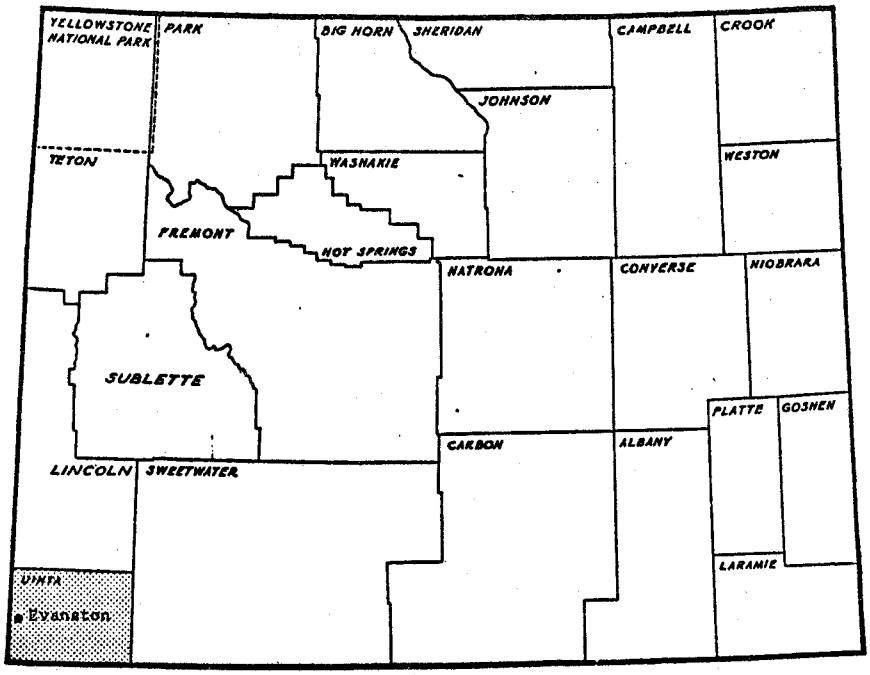

Figure 4. Study Areas in Wyoming

Fayette and Panola counties were surveyed by Texas A&M University using a technique similar to that in Uinta and Emery counties. Response rates for employee surveys were 40.5 percent (Fayette) and 28.7 percent (Panola). Again, no response rates were kept for business surveys.

Public sector employee surveys were distributed in conjunction with the community leaders survey previously mentioned. Since employer surveys were not part of this process, no response rates were available. Due to time and financial constraints, no public sector survey was performed in Emery County.

A profile of area trade sectors is presented in Table 2. As this table shows, business samples obtained were reasonably representative of the business sectors of the counties surveyed.

The Employer Survey

Preliminary Expections

Prior to gathering data on characteristics of the nonbasic[1] sector, a number of areas of special importance were identified and behavior of these

TABLE 2. PROFILE OF LOCAL BUSINESS SECTORS: SEVEN WESTERN COUNTIES, 1982

Counties	Employees	Annual Payroll ($000)	Number of Establishments (percent of total)	Establishments Surveyed (percent of total)
Emery				
Construction	500-999	D	13 (9.5)	0
Manufacturing	20- 99	D	2 (1.5)	0
Transportation	295	6,044	9 (6.6)	1 (6.7)
Wholesale	4	82	5 (3.6)	0
Retail	250-499	D	54 (39.4)	12 (80.0)
FIRE (Finance, Insurance, Real Estate)	45	410	9 (6.6)	1 (6.7)
Services	204	2,114	33 (24.1)	1 (6.7)
Nonclassifiable	18	107	12 (8.8)	0
	1,746	8,757	137 (100.1)	15 (100.1)
Fayette				
Construction	224	2,190	52 (9.7)	1 (2.9)
Manufacturing	591	6,732	24 (4.5)	--
Transportation	167	2,911	24 (4.5)	--
Wholesale	425	4,287	45 (8.4)	--
Retail	1,589	10,162	182 (33.9)	24 (68.6)
FIRE	233	2,418	48 (8.9)	7 (20.0)
Services	708	5,419	117 (21.8)	1 (2.9)
Nonclassifiable	61	586	45 (8.4)	2 (5.7)
	3,998	34,705	537 (100.1)	35 (100.1)
Hettinger				
Construction	58	924	15 (13.2)	7 (6.1)
Manufacturing	35	248	8 (7.0)	2 (1.8)
Transportation	34	585	7 (6.1)	4 (3.5)
Wholesale	100	1,120	19 (16.7)	6 (5.3)
Retail	149	1,104	28 (24.6)	50 (43.9)
FIRE	54	578	10 (8.8)	14 (12.3)
Services	175	1,027	17 (14.9)	16 (14.0)
Nonclassifiable	18	96	10 (8.8)	15 (13.2)
	623	5,682	114 (100.1)	114 (100.1)
McLean				
Construction	20- 29	D	23 (8.9)	5 (7.1)
Manufacturing	67	591	7 (2.7)	2 (2.9)
Transportation	81	1,543	12 (4.7)	4 (5.7)
Wholesale	259	2,909	43 (16.8)	8 (11.4)
Retail	429	2,750	85 (33.2)	29 (41.4)
FIRE	99	1,040	17 (6.6)	6 (8.6)
Services	435	3,319	58 (22.7)	8 (11.4)
Nonclassifiable	21	174	11 (4.3)	8 (11.4)
	1,416	12,326	256 (99.9)	70 (99.9)

- continued -

TABLE 2. PROFILE OF LOCAL BUSINESS SECTORS: SEVEN WESTERN COUNTIES, 1982 (CONTINUED)

Counties	Employees	Annual Payroll ($000)	Number of Establishments (percent of total)	Establishments Surveyed (percent of total)
Mercer				
Construction	153	2,826	24 (14.0)	10 (8.8)
Manufacturing	16	234	3 (1.8)	2 (1.8)
Transportation	364	8,061	10 (5.8)	1 (.9)
Wholesale	152	1,550	17 (9.9)	17 (14.9)
Retail	408	2,752	52 (30.4)	50 (43.9)
FIRE	83	1,264	15 (8.8)	10 (8.8)
Services	399	3,397	38 (22.2)	15 (13.2)
Nonclassifiable	20- 29	D	12 (7.0)	9 (7.9)
	1,600	20,084	171 (99.9)	114 (100.2)
Panola				
Construction	586	9,511	44 (13.0)	0
Manufacturing	760	7,468	18 (5.3)	0
Transportation	166	2,650	26 (7.7)	1 (5.3)
Wholesale	130	1,443	32 (9.4)	2 (10.5)
Retail	918	6,316	94 (27.7)	11 (57.9)
FIRE	198	2,583	21 (6.2)	3 (15.8)
Services	413	3,182	73 (21.5)	2 (10.5)
Nonclassifiable	47	539	31 (9.1)	0
	3,218	33,692	339 (99.9)	19 (100.0)
Uinta				
Construction	217	3,254	37 (11.1)	0
Manufacturing	180	2,359	11 (3.3)	0
Transportation	368	6,124	22 (6.6)	2 (20.0)
Wholesale	218	4,908	33 (9.9)	0
Retail	1,247	12,546	89 (26.7)	5 (50.0)
FIRE	172	2,795	19 (5.7)	1 (10.0)
Services	883	10,685	91 (27.3)	1 (10.0)
Nonclassifiable	20- 99	D	31 (9.3)	1 (10.0)
	3,310	42,671	333 (99.9)	10 (100.0)

D = Figures undisclosed.

SOURCE: U.S. Department of Commerce, Bureau of the Census, 1980, 1981.

variables hypothesized. Area employers were expected to face stiff competition for labor supplies due to the attractiveness of the high wages at the energy facilities. Not only would this create difficulty for employers in attracting new workers, but turnover rates were expected to increase as more employees of nonbasic industries went to work at the energy facilities. Compensation levels at area businesses would also have to be raised to retain present staffs. The stimulus to the county's economy provided by the new population and energy facilities was expected to spur expansion of existing businesses (both in inventory and personnel) and to attract new businesses.

One possible problem for small businesses in rapidly growing communities is the inability to obtain the capital needed to finance expansion and upgrading of the local business sector. As a result, firms from outside the area with greater access to financial resources (frequently chain stores) may move into an area to capitalize on the expanded markets (Denver Research Institute, 1982). Therefore, survey questions were included to ascertain if the proportion of chain stores to other business classes (privately owned or franchise) was changing. Results are summarized in Table 3.

Results

Emery County, Utah

The sample for Emery County consisted of 15 businesses from Huntington and Castle Dale. These businesses averaged just over 11 years in operation, with more than half being eight years old or less. Average number of employees (full- and part-time) had increased slightly over the 1977-82 period, from 4.2 to 4.8, or about 14 percent. Wages paid by area businesses averaged $4.42 per hour.

Responses to survey questions concerning employee attraction and retention indicated that few difficulties were experienced in these areas. Over 70 percent of the sample noted no difficulty attracting new workers while 75 percent did not feel that turnover had increased in the past five years. Most (61.6 percent) indicated that they had to increase wages "substantially" over the survey period. This increase averaged $1.52 per hour, or 48.1 percent, for the eight who increased wages.

Little evidence was found of large outside firms moving into local markets. Privately owned businesses accounted for 14 of the sample's 15 businesses; the remaining establishment was a franchise. Eight of the respondents, or 61.5 percent, indicated that they had expanded either floor space or inventory in the past five years, presumably to capture a larger volume of sales.

Fayette County, Texas

A sample of 35 businesses was taken in La Grange, Texas. These establishments' ages averaged 15 years, with a median value of 10 years. Number of employees fluctuated from a low of 8.1 in 1978 to a high of 10.6 in 1981. Average hourly wage paid was $4.64. As in Emery, attraction and

TABLE 3. CHARACTERISTICS OF SECONDARY BUSINESSES, SEVEN WESTERN COUNTIES, 1983

	Emery	Fayette	Hettinger	McLean	Mercer	Panola	Uinta
Wages Paid[a] (hourly)	$4.42	$4.64	$5.31	$6.40	$5.50	$4.00	$5.60
Business Age[a]	11	15	19	18	14	14	19
Number of Employees[a] (Full and Part Time)							
1977	4.2	8.3	3.3	5.2	3.1	4.7	17.6
1978	4.4	8.1	3.0	5.6	4.0	4.9	17.4
1979	4.4	8.3	3.4	6.0	4.8	4.9	15.8
1980	4.6	8.7	3.1	5.3	5.1	5.0	15.9
1981	4.5	10.6	3.0	5.7	5.5	6.0	15.1
1982	4.8	8.4	2.9	5.0	5.6	6.2	15.9
Wage Increase in Past Five Years							
Yes	8 (61.6)	11 (39.3)	41 (53.2)	36 (66.7)	59 (64.1)	5 (35.7)	4 (50)
No	5 (38.4)	17 (60.7)	36 (46.8)	18 (33.3)	33 (35.9)	9 (64.3)	4 (50)
Difficulty Attracting Quality Workers							
Yes	4 (28.6)	12 (38.7)	25 (27.5)	25 (39.7)	49 (46.2)	1 (6.3)	3 (30)
No	10 (71.4)	19 (61.3)	66 (72.5)	38 (60.3)	57 (53.8)	15 (93.7)	7 (70)
Increased Turnover							
Yes	3 (25)	7 (23.3)	14 (15.7)	20 (31.7)	42 (40)	3 (20)	2 (20)
No	9 (75)	23 (76.7)	75 (84.3)	43 (68.3)	63 (60)	12 (80)	8 (80)
Expansion in Past Five Years							
Yes	8 (61.5)	16 (51.6)	42 (35.9)	33 (50.8)	65 (57.5)	7 (46.7)	8 (80)
No	5 (38.5)	15 (48.4)	75 (64.1)	32 (49.2)	48 (42.5)	8 (53.3)	2 (20)
Business Type							
Franchise	1 (6.7)	4 (11.4)	3 (2.5)	6 (8.7)	4 (3.5)	--	--
National Chain	--	5 (14.3)	4 (3.3)	1 (1.4)	5 (4.4)	3 (15.8)	1 (10)
Regional Chain	--	1 (2.9)	2 (1.7)	0	3 (2.6)	3 (15.8)	--
Privately Owned	14 (97.3)	25 (71.4)	111 (92.5)	62 (89.9)	102 (89.5)	13 (68.4)	9 (90)
Sample Size	15	35	120	70	116	19	10

Numbers in parentheses are percent of total.
[a]Represents mean values.

retention of employees was not a serious problem. Less than half (39.3 percent) indicated that they had increased wages. Of these, average increase was $2.44 per hour, or 75.3 percent.

Most (71.4 percent) of the businesses surveyed were privately owned. Regional or national chains accounted for 17.2 percent of the sample; the remainder were franchises. Slightly over half of the businesses (51.6 percent) had expanded in the past five years.

Hettinger County, North Dakota

Chosen as a control sample for the study, the towns of Mott and New England in Hettinger County provided 120 observations. Of note is the observation that the survey and interviewer were received with more enthusiasm than in the other six counties, perhaps because the other counties have been subject to repeated impact surveys in the past several years. Average number of employees per business remained fairly constant over the survey period, fluctuating between 2.9 and 3.4 per firm. Average hourly wage of the sample was $5.31. The businesses also averaged about 19 years in operation, with a median value of 10 years.

Neither attraction nor retention of employees was a major problem, as 27.5 percent had difficulty attracting workers while only 15.7 percent noticed increased turnover. However, over half (53.2 percent) felt that wages had increased substantially over the survey period. Average wage increase for this subgroup was $1.59 per hour, or 39.7 percent.

Only 35.9 percent of the businesses sampled had expanded. This was expected, since Hettinger County is not experiencing the dynamic growth in population and markets that the other counties are. Only 5 percent of the sample were national or regional chain affiliates. Again, the majority (92.5 percent) were privately owned.

McLean County, North Dakota

Sample size for McLean County was 70 businesses. Average age of these establishments was 18 years; half had been in business eight years or less. Staff size ranged from 6.0 in 1979 to 5.0 in 1982, with the largest average number of employees occurring between 1978 and 1981, the peak employment years of the Coal Creek plant construction. Average hourly wage was $6.40, highest of the seven sample groups.

Difficulty attracting workers was viewed as a problem by less than half (39.7 percent) of the sample; 68.3 percent did not feel that turnover had increased. However, about two-thirds (66.7 percent) had made a substantial increase in hourly wages paid, averaging $1.93 or 49.7 percent. Only one business (1.4 percent) was part of a national or regional chain. Most (89.9 percent) were privately owned. Slightly over half (50.8 percent) had expanded in the past five years.

Mercer County, North Dakota

Mercer County provided the second largest business sample, with 116 establishments. Average staff size increased markedly from 3.1 in 1977 to 5.6 in 1982. Like McLean County, half of the sample had been in business eight years or less, possibly owing to the fact that both counties began experiencing their energy-related growth at approximately the same time. Average age of Mercer's businesses was 14 years. Average hourly wage paid was $5.50.

Mercer's businesses experienced the greatest difficulty attracting new workers, with 46.2 percent noting problems. County businesses also had the highest percentage (40.0) noting increased turnover, and the second highest percentage (64.1, behind McLean's 66.7) reporting wage increases. These phenomena may be attributable to the fact that Mercer is currently the most active county, with a May 1983 energy project work force of nearly 5,800 (ITAT, 1983) and the smallest population (9,404) of the six energy counties. Average wage increase was $1.85 per hour.

A high percentage (57.5) of businesses had expanded over the boom period. Still, nearly 90 percent of the businesses surveyed were privately owned, with chain operations accounting for 7 percent of total.

Panola County, Texas

This Texas county yielded a sample of 19 businesses. The average number of workers employed exhibited a steadily rising trend from 4.7 in 1977 to 6.2 in 1982. Mean years in operation was 14; median value was eight years. Average hourly wages paid in Panola were the lowest of the seven-county sample at $4.00.

Percentages of businesses experiencing greater turnover (20.0 percent) and difficulty attracting new employees (6.3 percent) were extremely low. This may be due to Panola County's large population (relative to the other sample areas) which provides ample labor supplies. The county also had the smallest percentage of businesses noting substantial wage increases (35.7 percent), which averaged $2.03 per hour, or a 50.8 percent increase.

Only 46.7 percent had expanded inventory or floor space; Panola was the only county (except Hettinger) in which less than half of the surveyed businesses had expanded. Finally, the county had the largest percentage of national or regional chains (31.6 percent) of the seven-county sample.

Uinta County, Wyoming

This Wyoming county, site of extensive oil and gas exploration and production, provided the smallest of the study's data sets; only 10 businesses responded. Average age of these businesses was 19, with a median age of 14 years. Average number of employees, though decreasing from 17.6 in 1977 to 15.9 in 1982, was substantially higher than for the other county samples. However, a survey of County Business Pattern data revealed that the business types surveyed in Uinta County generally have large staffs. Countywide,

transportation establishments averaged 16.7 employees, retail firms 14 employees, and service operations 9.7 employees. This indicates that the study sample is not contrary to county characteristics. Average hourly wage in Uinta was $5.60.

Although the county has experienced rapid growth, few employers noted either difficulty attracting workers or increased turnover (30 and 20 percent, respectively). Half of the sample had raised wages substantially, averaging $2.34 per hour, an increase of 69.2 percent.

Almost all firms (80 percent) had expanded. Only one firm, or 10 percent of the sample, was a chain operation. The remainder were privately owned.

Analysis

Although some of the results of the business survey coincided with preliminary expectations, several aspects were contrary to those anticipated. One key finding was that the vast majority of businesses in all counties were privately owned (ranging from 68.4 to 97.3 percent of the energy county total, with 85.9 percent of the overall sample). In a recent study of rapid-growth oil shale communities, it was found that, in many cases, retail chain operations move in, often bringing existing funding sources with them (Denver Research Institute, 1982). This was not the case in this study, because only 8.4 percent of the 265 businesses responding in energy counties were regional or national chains. This figure compares with 5 percent of businesses in Hettinger County being national or regional chains. Of these 22 chain stores in the six counties, only eight were founded after energy development in the county began. It is possible that sales volume for these newer chain stores may have captured a more-than-proportional share of the expanded area markets; however, no data on sales receipts were available to examine this possibility. A possible proxy for business volume might be found in average number of workers employed. Chain-store operations in the six energy counties employed an average of 8.4 full- and part-time employees in 1982, compared to 6.2 for the overall sample. Also of note is that 12 of these 22 chain-store firms were located in Panola and Fayette counties, the two areas with the largest populations.

Other impacts on local businesses often attributed to rapid growth are increased turnover, difficulty attracting workers, and the need for increased wages because many workers are attracted to the high wages paid by the energy facilities (Thomas et al., 1983; Murdock and Leistritz, 1979). However, most businesses responding indicated that they had experienced neither increased turnover nor difficulty attracting quality workers. The incidence of turnover in the six energy counties (32.7 percent) was higher than that reported in Hettinger County (15.7 percent); however, these differences were only statistically significant in Mercer and McLean counties (see Appendix A). In each case, Mercer County had the highest percentage of replies in the affirmative category (46.2 percent difficulty attracting new workers, 40 percent increased turnover). This seems to indicate that, due to the high incidence of immigration, adequate labor supplies are available for the sample group. Most businesses did indicate that they had to make a "substantial" increase in wages paid. As noted, these increases ranged from $1.52/hour in

Emery County to $2.44/hour in Fayette County. On a percentage basis, these increases varied from 39.7 percent (Hettinger) to 93.5 percent (Panola), as compared with an increase in the implicit price index of 48.9 percent over the same period. Hettinger County business owners also reported making substantial wage increases (53.2 percent of respondents) over this period. Only four counties--Panola, Fayette, McLean, and Uinta--raised wages by more than simple adjustments to offset inflationary effects would have increased them. Fayette and Panola, although each had percentage and absolute increases that were relatively large, still had the lowest wages of the seven-county sample, while the wage increase of 49.7 percent in McLean County is only marginally higher than the implicit price index increase of 48.9 percent. Hettinger County, the control, did experience smaller wage increases on both percentage and absolute bases. Yet, the study finds insufficient evidence on the basis of the overall results of these questions to support the hypothesis that rapid growth and energy development necessarily lead to higher turnover rates, increased difficulty attracting workers, and radically increased levels of employee compensation in the secondary business sector.

Most businesses had expanded over the survey period, and more than half of the businesses surveyed were established within the past 10 years. Only 35.7 percent of Hettinger County's businesses had expanded; this is significantly less than in McLean, Mercer, Emery, and Uinta counties. There is no significant difference between percentages of firms expanding in Hettinger and Panola counties (Appendix Table A1). As noted previously, this may be because energy development's impact on Panola was lessened by the size of its population. Overall, the results indicate that energy development does have a substantial expansionary impact on the local economy.

The Employee Survey

It was hypothesized that many of the employees surveyed might have a spouse working at one of the energy facilities. Monitoring reports from the Colony Oil Shale Project in Colorado (prior to phasedown) and the Mercer County construction sites have indicated that 52 percent and 34 percent, respectively, of relocating project workers moved to the impact area with their spouses (National Institute for Socioeconomic Research, 1981; ITAT, 1983). These spouses were believed to provide a large potential labor pool to fill secondary jobs. Residence years for employees was expected to show a low median value; that is, many workers were expected to have moved to the area since the energy development started. Key responses are listed in Table 4.

Results

Emery County

The number of respondents in Emery County was 29, of which 21, or 72.4 percent, were married. Nine of these married respondents (42.9 percent) had a spouse employed at one of the energy facilities. The majority of the sample were employed in sales-type occupations in the retail sector. Most (79.3 percent) of the sample were female. Average family size of married

TABLE 4. CHARACTERISTICS OF SECONDARY BUSINESS WORKERS, SEVEN WESTERN COUNTIES, 1983

	Emery	Fayette	Hettinger	McLean	Mercer	Panola	Uinta
Number of Dependents per Married Worker[a]	3.3	2.3	2.7	2.6	2.6	2.4	2.3
Marital Status							
Married	21 (72.4)	78 (70.3)	115 (72.3)	93 (64.4)	189 (60.0)	21 (63.6)	22 (68.7)
Single	8 (27.6)	33 (29.7)	44 (27.7)	44 (33.6)	126 (40.0)	12 (36.4)	10 (31.3)
Spouse Occupation							
Energy	9 (42.9)	9 (11.5)	4 (3.5)	19 (20.4)	42 (22.2)	5 (26.3)	11 (47.8)
Nonenergy or Not Employed	12 (57.1)	69 (88.5)	111 (96.5)	74 (79.6)	147 (77.8)	14 (73.7)	12 (52.2)
Previous Residence							
County	10 (37.1)	30 (39)	32 (26.7)	21 (17.2)	56 (21.0)	7 (25.9)	3 (10)
Elsewhere in State	9 (33.3)	40 (51.9)	65 (54.2)	77 (63.1)	135 (50.8)	18 (66.7)	6 (20)
Out of State	8 (29.6)	7 (9.1)	23 (19.1)	24 (19.7)	75 (28.2)	2 (7.4)	21 (70)
Years of Local Residence[a]	12.6	18.5	18.1	13.3	9.8	9.8	6.3
Gender							
Male	6 (20.7)	43 (40.6)	72 (45.6)	64 (46.0)	155 (50.2)	0	6 (18.7)
Female	23 (79.3)	63 (59.4)	86 (54.4)	75 (54.0)	154 (49.8)	31 (100.0)	26 (81.3)
Age[a]	36.8	34.2	37.1	32.3	31.7	28.3	32.1
Wage Received[a]	$4.55	$5.58	$5.74	$4.84	$5.89	$3.93	$5.74
Expected Length of Stay							
Less than 3 months	0	2 (1.9)	1 (0.7)	2 (1.6)	b	--	--
3-11 months	0	0	4 (2.6)	4 (3.1)		2 (7.4)	--
1-2 years	4 (14.8)	3 (2.8)	10 (6.6)	7 (5.5)		1 (3.7)	3 (11.1)
3-5 years	4 (14.8)	4 (3.8)	6 (4.0)	17 (13.4)		2 (7.4)	3 (11.1)
Permanently	19 (70.4)	97 (91.5)	130 (86.1)	97 (76.4)		22 (81.5)	21 (77.8)
Sample Size	29	111	159	140	315	33	32

Numbers in parentheses are percent of total.
[a]Represents mean values.
[b]This question was not asked of Mercer County respondents.

workers (spouse and children, excluding respondent) was 3.3, and the average worker's age was 36.8.

Over 70 percent of the sample intended to reside in the area permanently. Average years of residence in Emery County was 12.6, while half of the sample had been in the county seven years or less. Over 60 percent of the sample listed a previous residence outside of the county.

Average hourly wage was $4.55. Respondents also held an average of 2.4 jobs over the past five years; average number of years at present job was 3.7. Distance traveled to work averaged 3.8 miles.

Fayette County

Fayette County provided a sample of 111 respondents, of which 70.3 percent, or 78, were married. Only nine (11.5 percent) of these married workers had a spouse employed at an energy facility, the lowest percentage of the six energy counties, but peak construction work force in Fayette was the smallest relative to county population. The plant's operating work force of 230 accounts for only 1.2 percent of county population; therefore, the low percentage of spouses employed at energy facilities is not surprising. Like Emery County, most of the sample were employed in sales work in the retail sector, with a substantial percentage (36.9 percent) in the finance sector. Average family size was 2.3, and the average respondent's age was 34.2. Over half (59.4 percent) of the sample were female.

The county sample lists the highest percentage of respondents indicating an expectation of permanent residence in the county (91.5). Average years of residence is also highest for the overall sample (18.5). The median years of residence, 17, further emphasizes the stability of the sample population.

Average hourly wage was $5.58 for an average of 1.7 jobs held over the five-year survey period. Average years at present job was 7.5. Distance traveled to work averaged 5.6 miles.

Hettinger County

Hettinger, the control county for the study, provided 159 observations. Married workers accounted for 115 (72.3 percent) of the sample group; four of these (3.5 percent) had spouses working at an energy facility and possibly commuted to Dickinson in neighboring Stark County where considerable oil development occurs. As in the energy counties, more workers were employed in retail sales than any other occupation or sector. Just over half (54.4 percent) were female; average family size per married worker was 2.7, and mean worker's age was 37.1 years.

As expected, a high percentage (86.1) of the sample intended to reside in the area permanently. The stability of the county population was further emphasized by the average years of residence of 18.1 per worker. Average hourly wage was $5.74, which was comparable to the other counties. Average number of jobs over the past five years was 1.7; years on present job averaged 6.8. Average distance traveled to work was 2.1 miles.

McLean County

McLean County was the second North Dakota county surveyed, and provided 140 survey responses. Although the Coal Creek Power Station and its associated mines have reached operating status, a high percentage (20.4) of married workers, which make up 64.4 percent of the county sample, had spouses working at the energy facilities. Over half (53.6 percent) worked in the retail sector; 48.6 percent held sales positions. Average number of dependents per worker was 2.6; average age was 32.3 years. Most of the sample (54.0 percent) were female.

About three-quarters of the sample intend to reside in McLean County permanently. Average years of residence was 13.3; however, median value for this variable was only seven years.

Average hourly wage of $4.84 was the lowest of the three North Dakota counties surveyed. Average years on the job was 5.7, while average number of jobs held over the five-year period was 2.1. Distance traveled to work was 1.9 miles.

Mercer County

Mercer County's sample of 315 workers was the largest of the seven counties. Exactly 60 percent (189) were married and had an average family ze of 2.6. About one worker in five (22.2 percent) had a spouse working at an energy facility. Average age was 31.7 years.

Average years of residence was 9.8 and median residence years was 5.0. Only 21 percent of the sample listed a previous residence within the county.

Hourly wage averaged $5.89, highest of the overall sample. Average years on the job was 4.2, and average number of jobs held (past five years) was 2.3. Average distance to work place was 6.2 miles.

Panola County

This Texas county provided a sample of 33 workers. Most of these workers (63.6 percent) were married, and about one-fourth (26.3 percent) had spouses employed at the energy facilities. Average family size was 2.4, and all of the respondents were female. As in all of the other surveyed counties, most of the sample were employed in retail sales. Average years of residence was 9.8; average age was 28.3 years. About four-fifths (81.5 percent) of the sample intended to stay in the area permanently.

Panola's average hourly wage of $3.93 was the lowest of the sample. Respondents held an average of 2.4 jobs over the five-year survey period, and years at current job averaged only 2.0.

Uinta County

The seventh county surveyed, Uinta, yielded 32 usable observations. This county had the highest percentage of married workers with a spouse

employed at an energy facility (47.8 percent). Married workers accounted for 68.7 percent of the sample, and 81.3 percent of the sample were female. Average number of dependents was 2.3; average age was 32.1 years.

Although only 10 percent of the sample were native to the county, 77.8 percent intended to stay in the area permanently. Average years of residence, at 6.3 years, was the lowest of the seven counties. Median years of residence was one or less.

Average hourly wage was $5.74. Average years on the job was 4.2, and number of jobs held over the past five years averaged 2.5. Distance traveled to work averaged 2.8 miles.

Analysis

As previously stated, it was presumed that the large number of spouses of workers at the energy facilities might fill many of the secondary business jobs. However, employees with spouses employed at the energy projects ranged from 11.5 percent in Fayette to 20.4 percent (McLean), 22.2 percent (Mercer), and 26.3 percent (Panola). Emery (42.9 percent) and Uinta (47.8 percent) did have a substantial proportion of energy-employed spouses responding but, due to sampling procedures, these two counties accounted for only 9.2 percent of the total sample. Overall, 22.5 percent of the six-county sample had spouses working at an energy facility.

Given this statistic, the large number of secondary workers that had immigrated from outside the county becomes especially important. Of these, many had previously resided out-of-state. Locals (nonmigrants) accounted for between 10 percent (Uinta) and 39 percent (Fayette) of the responding population. An interesting fact is that the two counties with the lowest percentage of out-of-state immigrants, Panola (7.4) and Fayette (9.1), were also the two largest counties of the sample; both were also in the state with the largest population (Texas) of the four surveyed. Immigrants accounted for 76.8 percent of the six-county sample, with 25 percent of the total work force immigrating from out-of-state. In spite of the large numbers of inmigrants, most indicated that they intend to stay in the area permanently, ranging from 70.4 percent in Emery to 91.5 percent in Fayette, and 81.5 percent of the total (Mercer County residents were not asked this question).

From a planning standpoint, this indicates that in addition to locals and immigrating energy work forces and dependents, there is a third group to be considered by planners: immigrating secondary workers and their families.[2] Respondents averaged from 2.3 (Fayette and Uinta) to 3.3 (Emery) dependents per family; combined with the fact that 64.2 percent of the sample were married, this group can have a substantial impact on an area's population growth and, consequently, on demand for housing and public services. These family sizes for secondary workers are, with the exception of Uinta, greater than the overall population's average for each county. Number of dependents per married worker ranged from 0.5 (Emery) to 0.3 dependents (McLean) more per family than census figures (Bureau of the Census, 1982).

The majority of respondents surveyed owned their own home; ownership rates ranged from a low of 66.7 percent in Panola County to 80.6 percent in

Uinta County. Single-family homes were the preferred dwelling. Cross-referencing questions by residence type occupied and residence type preferred yielded a "satisfaction ratio (SR)" representing the percentage of respondents living in their preferred housing type. The lowest SR occurred in Uinta (46.2), which also had the highest rate of home ownership. The second lowest SR (55.2) occurred in Panola, while the highest (82.7) was in Fayette County. (Further information on actual vs. preferred housing type is provided in Appendix E.)

It is possible that communities may want to take steps prior to project development to lessen secondary worker inmigration, just as many mitigation plans try to reduce project work force inmigration (Leistritz et al., 1982; Halstead et al., 1982). Active recruitment of unemployed local workers and energy-related spouses and dependents by local businesses can decrease the need for additional outside workers to fill secondary jobs. Ensuring that adequate, reasonably priced day-care facilities are available for parents wishing to join the labor force may also prove useful.

Analysis by Length of Residence

Average years of residence in the six energy counties ranged from 6.3 in Uinta to 18.5 in Fayette, but median years of residence for respondents in these counties was less than the number of years elapsed since the energy project began. In other words, more than half of the respondents had moved to the area since the energy development started construction. The one exception to this was Fayette County, which had a median residence value of 17 years. This may be because the size of Fayette's project work force (867) was small relative to the county population (17,650 in 1970), so that the area's growth was not as dramatic as in the other study areas.

Given this trend, we decided to create a subgroup of newcomers who had arrived in the area since the project(s) began (Table 5). As might be expected, a higher percentage of this subgroup had a spouse employed at an energy facility (27 percent) than the total sample (22.5 percent). With the exception of Panola, the average age of the subset population is less than the total's average. Very little variation in family size (number of dependents) is noted between the newcomer subgroup and all respondents.

Wages received by these recent inmigrants are marginally lower than in the total sample, possibly owing to fewer years on the job for newcomers. Finally, although a majority of the subset intends to stay in the area permanently, larger percentages envision their residency as temporary than do the total sample. Characteristics of this subgroup are listed in Table 5.

Analysis of Wage Level Determinants

An econometric model of possible wage-influencing variables was constructed for the data set, and ordinary least squares[3] (OLS) regressions were performed. Chow tests performed on all possible two-set combinations of the seven data sets yielded F-values that were below critical F in every case (see Appendix B). Therefore, the data sets were pooled, yielding 295 usable observations for the six energy counties.

TABLE 5. CHARACTERISTICS OF RECENTLY INMIGRATING SECONDARY BUSINESS WORKERS, SIX WESTERN COUNTIES, 1983

	Emery	Fayette	McLean	Mercer	Panola	Uinta
Number of Dependents per Married Worker[a]	3.5	2.3	2.7	2.6	2.3	1.9
Marital Status						
Married	12 (80.0)	32 (68.1)	54 (74.0)	120 (63.1)	17 (77.3)	17 (70.8)
Single	3 (20.0)	15 (31.9)	19 (26.0)	70 (36.9)	5 (22.7)	7 (29.2)
Spouse Occupation						
Energy	7 (63.6)	7 (21.9)	12 (22.8)	26 (21.7)	4 (26.7)	11 (68.8)
Nonenergy or Not Employed	4 (36.4)	25 (78.1)	42 (77.8)	94 (78.3)	11 (73.3)	5 (31.2)
Previous Residence						
County	7 (46.7)	12 (26.7)	8 (11.3)	29 (15.6)	5 (23.8)	2 (8.3)
Elsewhere in State	3 (20.0)	27 (60.0)	48 (67.6)	99 (53.2)	4 (66.7)	4 (16.7)
Out of State	5 (33.3)	6 (13.3)	15 (21.1)	58 (31.2)	2 (9.5)	18 (75.0)
Years of Local Residence[a]	3.6	3.8	3.7	2.9	4.5	1.8
Gender						
Male	3 (25.0)	16 (35.6)	31 (42.5)	98 (52.4)	0	5 (20.8)
Female	12 (75.0)	29 (64.4)	42 (57.5)	89 (47.6)	21 (100.0)	19 (79.2)
Age[a]	31.4	26.5	28.1	30.0	30.1	30.0
Wage Received[a]	$4.19	$5.14	$4.69	$5.92	$4.00	$5.70
Expected Length of Stay						
Less than 3 months	--	2 (4.4)	2 (2.9)	b	--	--
3-11 months	--	1 (2.2)	2 (2.9)		--	--
1-2 years	3 (21.4)	2 (4.4)	4 (5.9)		1 (5.5)	3 (15.0)
3-5 years	3 (21.4)	3 (6.7)	11 (16.2)		1 (5.5)	3 (15.0)
Permanently	8 (57.2)	37 (82.2)	49 (72.1)		16 (88.9)	14 (70.0)
Sample Size	15	47	73	190	22	24

Numbers in parentheses are percent of total.
[a]Represents mean values.
[b]This question was not asked of Mercer County respondents.

Eight variables were included: years on the job, wage at previous job, years of residence in the surveyed county, distance traveled (one way) to work, age, sex, and level of education. Results are summarized in Table 6.

TABLE 6. REGRESSION ANALYSIS TO IDENTIFY INFLUENCES ON SECONDARY BUSINESS WAGE LEVELS, SIX WESTERN COUNTIES, 1982. DEPENDENT VARIABLE = HOURLY WAGE, IN CENTS. EQUATION ONE

Variable	Coefficient	T-statistic	Expected Sign
Years at Present Job	10.92	3.57*	Positive
Wage at Previous Job	.29	6.13*	Positive
Years of County Residence	- 1.28	-1.20	Positive
Number of Jobs Held, Past Five Years	- 22.77	-3.01*	Negative
Distance Traveled (One Way) to Work	2.58	2.12	Positive
Sex (dummy: 0 = male; 1 = female)	-131.89	-6.25*	Indeterminate
Age	.83	.90	Positive
Education (five levels, primary through college)	57.55	5.49*	Positive

R^2 = .451.
Mean of dependent variable = 515.6.
n = 295; degrees of freedom = 286.
*Significant at 99 percent level.

The coefficient of determination (R^2) was .451. Although the model explains 44 percent of the variation in hourly wage, additional variables may be necessary to provide a better "fit." Years of residence, a variable included to determine if long-time residents had an edge in the job market, was not significant. The two variables representing work experience, years on job and previous wage level, were significant, as expected. Education level of respondents was also an important determinant, as an increase of one level in educational attainment resulted in an hourly wage increase of 58 cents (levels of education were: primary, some high school, high school, some college, and college).

The distance variable indicated that for every mile traveled to work, hourly wage increased by about three cents. This probably indicates that employees are willing to drive farther to work to receive higher wages rather than that longer distances generate higher wages. However, given that the mean of this variable is only four miles, its impact on hourly wage is minimal.

Regression analysis on the variable representing number of jobs held over the past five years indicated that frequent changing of jobs had negative financial consequences. Each additional job held over the period resulted in a loss of 23 cents per hour. However, when considering that average number of jobs was about two and that maximum value for the data set was seven (median value was between one and two), the variable's relative importance is reduced.

The sex dummy variable indicated that women averaged about $1.32 less per hour than men. Evidence of recent studies suggests that these results are not surprising (Smith, 1979). However, further analysis to isolate causes of this phenomenon were performed. Since education was known to affect wage levels, cross-referencing of sex by education was performed. In the sample, 79.7 percent of females surveyed had a high school degree or beyond, compared to 83.3 percent of males surveyed.

Breakdowns by sex and occupation also revealed that 86.9 percent of the female sample was concentrated in the two lowest paying occupational categories, sales and service, compared to 30.2 percent of males. In contrast, 55 percent of males are employed in the two highest paying occupations, craft and professional, compared to 11.4 percent of females surveyed. Therefore, a model was constructed which considered the influence of occupational factors. Six occupational categories were added to the model through the use of dummy variables (Table 7). Although none of these variables are significant at the 90 percent level, their addition had the effect of lowering the coefficient of the sex dummy from -131.89 to -101.67. This model specification compensates for the fact that much of the female work force is concentrated in lower paying occupations. As expected, the R^2 value increases from .451 to .482 with the addition of the new variables.

The Public Sector Survey

Conducted in conjunction with a community leaders survey of energy-impacted communities, this survey was almost identical to the business employee survey. Respondents included school district, health, law enforcement, and fire protection employees, as well as library, recreational, and county agent staff. Results are summarized in Table 8.

It was initially hypothesized that these individuals might be better paid, more educated, and average longer job tenure and residence years than their counterparts in the employee survey. As the next section indicates, this was generally the case (Table 8).

Results

As expected, the survey results reveal a population that was better educated, higher paid, and older than the private sector group. Over 50 percent possessed a college degree, compared to only 6.5 percent of the employee sample. Years at current job was also higher, averaging from 5.5 years in Uinta to 11.0 in Fayette. A related statistic, number of jobs over the past five years, showed less frequent job changing. With the exception of Uinta, higher percentages of the sample were married for all six counties surveyed. However, of those married, percentages with spouses at an energy

TABLE 7. REGRESSION ANALYSIS TO IDENTIFY INFLUENCES ON SECONDARY BUSINESS WAGE LEVELS, SIX WESTERN COUNTIES, 1982. DEPENDENT VARIABLE = HOURLY WAGE, IN CENTS. EQUATION TWO

Variable	Coefficient	T-statistic	Expected Sign
Years at Present Job	10.23	3.34*	Positive
Wage at Previous Job	.26	5.53*	Positive
Years of County Residence	- 1.25	-1.18	Positive
Number of Jobs Held, Past Five Years	- 23.27	-3.04*	Negative
Distance Traveled (One Way) to Work	2.69	2.23	Positive
Gender (dummy: 0 = male; 1 = female)	-101.67	-3.97*	Indeterminate
Age	.78	.85	Positive
Education (five levels, primary through college)	52.47	4.98*	Positive
Occupation Variables (dummy)			
Professional	57.94	.36	Positive
Sales	- 7.46	- .05	Negative
Laborer	- 47.30	- .29	Indeterminate
Service	- 42.00	- .26	Negative
Craft	78.39	.49	Positive

R^2 = .482.
Mean of dependent variable = 515.6.
n = 295; degrees of freedom = 281.
*Significant at 99 percent level.

facility were comparable to those of the employee group. Years of residence averaged lower for the public sector sample in Fayette, Hettinger, and McLean, and slightly higher in Mercer, Panola, and Uinta. Finally, a slightly higher percentage of the overall public sector sample (84.9) than of the business employee sample (83.0) indicated permanent residence intent.

Mean income levels for this group were higher than in the employee sector, because many respondents held professional positions. Mean age was also higher for the public sector sample. Possibly as a result of this, family sizes were also slightly larger.

Some comparisons are also provided by housing characteristics. Using the satisfaction ratio (SR) derived in the previous section, the SR ranges from

TABLE 8. CHARACTERISTICS OF PUBLIC SECTOR EMPLOYEES, SIX WESTERN COUNTIES, 1983

	Fayette	Hettinger	McLean	Mercer	Panola	Uinta
Number of Dependents per Married Worker[a]	2.4	2.6	2.4	2.4	2.4	3.0
Marital Status						
Married	57 (80.3)	81 (78.6)	22 (81.5)	38 (76.0)	40 (95.2)	18 (66.7)
Single	14 (19.7)	22 (21.4)	5 (18.5)	12 (24.0)	2 (4.8)	9 (33.3)
Spouse Occupation						
Energy	7 (11.1)	0	8 (27.6)	9 (23.7)	11 (27.5)	1 (5.6)
Nonenergy or Not Employed	56 (88.9)	81 (100.0)	21 (72.4)	29 (76.3)	29 (72.5)	17 (94.4)
Previous Residence						
County	11 (17.7)	32 (36.0)	3 (12.0)	5 (10.6)	9 (23.7)	6 (23.1)
Elsewhere in State	48 (77.4)	43 (48.3)	18 (72.0)	33 (70.2)	23 (60.5)	2 (7.7)
Out of State	3 (4.8)	14 (15.7)	4 (16.0)	9 (19.1)	6 (15.8)	18 (69.2)
Years of Local Residence[a]						
Gender						
Male	12 (16.9)	38 (37.6)	5 (18.5)	19 (38.0)	6 (14.3)	9 (33.3)
Female	59 (83.1)	63 (62.4)	22 (81.5)	31 (62.0)	36 (85.7)	18 (66.7)
Age[a]	37.6	38.5	36.2	36.1	37.5	40.4
Annual Income ($)						
0- 4,999	0	0	1 (3.7)	4 (8.2)	0	0
5,000- 9,999	7 (10.3)	20 (25.0)	9 (33.3)	4 (8.2)	10 (23.8)	2 (7.4)
10,000-14,999	23 (33.8)	39 (48.7)	7 (25.9)	10 (20.4)	12 (28.6)	5 (18.5)
15,000-19,999	29 (42.6)	16 (20.0)	8 (29.6)	20 (40.8)	6 (14.3)	4 (14.8)
20,000-24,999	7 (10.3)	2 (2.5)	1 (3.7)	9 (18.4)	9 (21.4)	7 (25.9)
25,000-29,999	1 (1.5)	2 (2.5)	1 (3.7)	2 (4.1)	5 (11.9)	5 (18.5)
30,000+	1 (1.5)	1 (1.3)	0	0	0	4 (14.8)
Expected Length of Stay						
Less than 3 months	--	--	--	--	--	--
3-11 months	2 (2.9)	2 (2.1)	--	--	--	--
1-2 years	3 (4.4)	6 (6.4)	5 (18.5)	2 (4.1)	1 (2.5)	--
3-5 years	3 (4.4)	7 (7.4)	5 (18.5)	5 (10.2)	2 (5.0)	3 (11.1)
Permanently	60 (88.2)	79 (84.0)	17 (63.0)	42 (85.7)	37 (92.5)	24 (88.9)
Sample Size	71	103	27	50	42	27

[a]Represents mean values.
Numbers in parentheses are percent of total.

74.1 (McLean, Uinta) to 91.2 (Fayette). In every county, the public sector SR was higher than the secondary employee SR (Table 9). Higher percentages of respondents in the public sector survey also owned their own home. These higher SR's may be caused by either higher income or a related factor, greater average age, or by a combination of the two.

Conclusions

The surveys conducted in this study confirmed some initial hypotheses while disproving others. The contention that energy development stimulates the secondary business sector seems to be justified, because many firms reported expansion and a large number of establishments were founded after the areas' energy projects began. However, prior speculation on development causing higher turnover, difficulty attracting new workers, and much higher wages would seem unfounded. Although a high percentage of employers felt that they had increased worker compensation substantially, analysis indicated that these increases were generally no more than simple cost-of-living adjustments. Few employers noted severe problems in employee attraction or retention. Overall, the survey did not verify some of the supposed negative impacts which energy development causes on secondary businesses. It should be noted that employers in the control, nonimpacted county experienced lower turnover, less difficulty attracting workers, and less need to increase compensation than those in the six energy counties.

Results of the employee survey revealed two important points. First, a high percentage of these workers were recent inmigrants to the county; second, only about one employee in five had a spouse working at an energy facility. These findings indicate that inmigrating secondary workers and their dependents may constitute a substantial portion of population increases in energy-impacted counties, whereas it was previously assumed that many or most of the workers filling secondary jobs were either locals or relatives of inmigrating project workers. There was also a discrepancy between current housing type and housing type desired; that is, many respondents were not occupying their preferred housing type. This may have been partly the result of restricted housing supply in energy-impacted communities; it may also have stemmed from high mortgage rates or low income levels in the area.

Public sector employees were better educated, higher paid, and less likely to change jobs than their private sector counterparts. Satisfaction ratios for housing types were also higher for this group. Percentages of public sector employees with a spouse at an energy facility were comparable to the private sector.

TABLE 9. HOUSING CHARACTERISTICS OF PRIVATE AND PUBLIC SECTOR EMPLOYEES SURVEYED

Home Ownership	Emery	Fayette	Hettinger	McLean	Mercer	Panola	Uinta
Private Sector							
Own	19 (65.5)	83 (79.0)	116 (75.8)	96 (72.7)	214 (76.4)	20 (66.7)	25 (80.6)
Rent	10 (34.5)	22 (21.0)	37 (24.2)	36 (27.3)	66 (23.6)	10 (33.3)	6 (19.4)
Public Sector							
Own	NA	59 (83.1)	81 (79.4)	20 (74.1)	42 (84.0)	37 (88.1)	22 (81.5)
Rent	NA	12 (16.9)	21 (20.6)	7 (25.9)	8 (16.0)	5 (11.9)	5 (18.5)
Satisfaction Ratios[a]							
Private Sector	92.3	82.7	75.8	71.4	67.4	55.2	46.2
Public Sector	NA	91.2	86.9	74.1	78.0	90.0	74.1

[a]Satisfaction Ratio = $\frac{\text{Number of Families Occupying Their Preferred Housing Type}}{\text{Total Number of Families}}$

NA = Not Available.
Numbers in parentheses are percentages.

ENDNOTES

1. The nonbasic sector is defined here as those businesses in the surveyed county not directly supplying goods or services to the energy facilities in the county.

2. It is possible that some of these inmigrants had moved to the area hoping to obtain a job at one of the energy projects, and were working their present job while waiting for a position at the plant or mine to become available. No attempt was made to control for this.

3. This technique utilizes the OLS estimator, which generates the set of values of the parameters that minimizes the sum of square residuals. The residuals consist of the actual values of the dependent variable less the values which the model estimates.

APPENDIX A

A series of t-tests were run on key characteristics of secondary businesses surveyed to determine whether statistically significant differences existed between Hettinger County (the control) and the six energy counties. These characteristics were: incidence of increased turnover; difficulty attracting quality workers; whether or not a substantial wage increase was paid over the survey period; amount of wages paid; whether or not expansion of facilities had occurred; and amount of wage increase. Table A1 shows the

TABLE A1. RESULTS OF T-TESTS BETWEEN HETTINGER COUNTY BUSINESSES AND SIX ENERGY COUNTY BUSINESSES

County	Increased Turnover	Difficulty Attracting Workers	Wage Increase	Wages Paid	Expansion	Amount of Wage Increase
Emery	-.8 (.425)	-.08 (.933)	-.55 (.584)	-1.57 (.12)	-1.81 (.07)*	-.07 (.947)
Fayette	-.94 (.349)	-1.17 (.243)	1.26 (.209)	-1.6 (.113)	-1.6 (.113)	1.35 (.186)
McLean	2.42 (.017)**	1.46 (.145)	1.54 (.126)	-.40 (.69)	1.96 (.051)*	-1.25 (.215)
Mercer	3.84 (.001)***	2.75 (.007)***	1.43 (.15)	-.57 (.574)	3.35 (.001)***	1.39 (.167)
Panola	.41 (.683)	-1.84 (.069)*	-1.2 (.232)	2.36 (.02)**	.81 (.42)	-.62 (.538)
Uinta	.344 (.731)	.168 (.867)	-.17 (.863)	-.37 (.709)	2.8 (.006)***	-.95 (.349)

*Significant at 90 percent confidence level.
**Significant at 95 percent confidence level.
***Significant at 99 percent confidence level.

NOTE: Numbers in parentheses are the probability of a greater absolute t value.

t-statistic and confidence level for these tests. Figures represent a separate test performed for Hettinger County and each county listed, using a SAS Proc T Test program.

APPENDIX B

In order to combine the data sets and run a single regression model, statistical tests must be made to determine whether the data in these models are from the same universe. Pooled models were run on every possible two-set combination of the data sets, and F-tests were performed to determine whether this pooling was justifiable. In every model, calculated F was lower than critical F; therefore, since every two-set combination was justified, any combination of more than two sets was statistically correct. The procedure used in this F-test was

$$\frac{SSE_c - SSE_u \;/\; R}{SSE_u \;/\; T - K}$$

where: SSE_c = Sum of squared errors, constrained (pooled) model;

SSE_u = Sum of squared errors, unconstrained models;

R = Number of restrictions;

T = Number of observations, unconstrained models;

K = Number of regressors, unconstrained models.

Results are summarized in Table B1.

TABLE B1. CHOW (F) TESTS TO DETERMINE POOLING POSSIBILITIES FOR WAGE DETERMINANT MODELS

	Emery	Fayette	Hettinger	McLean	Mercer	Panola	Uinta
Emery (443,804)[a] df=10	--						
Fayette (968,706) df=30	1,441,881[b] 2.12[c] .09[d] (A)[e]	--					
Hettinger (2,427,536) df=41	2,874,915 2.08 .01 (A)	3,423,131 2.03 .06 (A)	--				
McLean (1,169,280) df=50	1,620,466 2.04 .03 (A)	2,197,046 2.01 .25 (A)	3,637,509 2.00 .11 (A)	--			
Mercer (10,058,595) df=140	10,579,975 1.96 .12 (A)	11,145,125 1.88 .20 (A)	12,586,335 1.88 .16 (A)	11,574,120 1.88 .65 (A)	--		
Panola (87,646) df=3	583,281 2.71 .14 (A)	1,170,080 2.20 .39 (A)	2,609,665 2.11 .18 (A)	1,294,420 2.08 .18 (A)	10,389,507 1.88 .38 (A)	--	
Uinta (36,050) df=8	537,959 2.46 .24 (A)	1,084,076 2.12 .33 (A)	2,516,136 2.08 .17 (A)	1,345,710 2.08 .75 (A)	10,097,077 1.88 .04 (A)	309,347 2.90 1.83 (A)	--

[a]Residual sum of squares, individual model.
[b]Residual sum of squares, pooled model.
[c]Critical F.
[d]Calculated F.
[e]Accept (A) or Reject (R) pooling hypothesis. If $F_{calc} < F_{crit}$, accept (A).

APPENDIX C

NORTH DAKOTA STATE UNIVERSITY

North Dakota Energy Impacts Study

EMPLOYER SURVEY

This survey is being conducted by the Department of Agricultural Economics at North Dakota State University to help estimate the impacts of energy development on support industries in Mercer and McLean counties. Your participation will help in developing plans to aid small communities in dealing with rapid growth. Your answers will be strictly confidential.

1. What type of business do you run? (Name) _____

2. What year and month was your business established? _____

3. How many workers do you employ?

	Full Time	Part Time
	_____	_____

4. How many workers did you employ in:

	Full Time	Part Time
1977	_____	_____
1978	_____	_____
1979	_____	_____
1980	_____	_____
1981	_____	_____

5. What is the average hourly wage you pay your employees? _____

6. Has this average wage increased substantially over the past five years? _____

   If yes, by approximately how much? _____

(The following questions relate to the past five years.)

7. Have you noticed any increased difficulty in attracting quality workers? _____

8. Have you experienced increased turnover rates? _____

9. Has your business expanded lately (either in floor space or quantity and types of goods sold)? _____

10. Is your business a:
    _____ franchise
    _____ part of a national chain
    _____ part of a regional chain
    _____ privately owned

11. How many employee surveys did you distribute to your workers? _____

Thank you for your cooperation. If you want a copy of the final report, please fill out the form furnished by the interviewer.

ADDITIONAL COMMENTS

APPENDIX D

NORTH DAKOTA STATE UNIVERSITY

North Dakota Energy Impacts Study

This survey is being conducted by North Dakota State University in order to estimate the effects of energy facility development on Mercer and McLean counties. All answers will be strictly confidential--do not write your name on this survey. Please fill out this survey and return it to your employer. Your cooperation is appreciated.

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

2. What type of business/profession do you work in? (i.e., hospital, school, etc.) _____

3. How long have you worked at this job? _____

4. What is your annual salary?

_____ 0-4,999	_____ 10,000-14,999	_____ 20,000-24,999	_____ 30,000+
_____ 5,000-9,999	_____ 15,000-19,999	_____ 25,000-29,999	

5. Are you married or single? _____ Married _____ Single

6. What is your husband/wife's occupation? _____

7. What type of business does he/she work in? _____

8. How long has he/she worked at that job? _____

9. Please list your work history for the past five years.

Occupation	City, State	Annual Salary	Year

10. How far do you travel (one way) to work? _____

11. Where is your local place of residence? _____ (Town)

12. How long have you lived there? _____

13. Where did you live before that? _____ (City, State)

14. Do you own or rent your home? _____ Own _____ Rent

OVER

15. Do you live in:

_____ Single Family Home	_____ Motel
_____ Apartment	_____ Travel Trailer
_____ Town House/Condominium	_____ Camper, Van
_____ Mobile Home	_____ Other (Specify) _____

16. What type of housing do you prefer?

_____ Single Family Home	_____ Motel
_____ Apartment	_____ Travel Trailer
_____ Town House/Condominium	_____ Camper, Van
_____ Mobile Home	_____ Other (Specify) _____

17. How long do you expect to stay in this area?

_____ Less than 3 months
_____ 3-11 months
_____ 1-2 years
_____ 3-5 years
_____ permanently

18. Sex: Male _____ Female _____

19. Number of dependents (spouse and children) living with you at your local place of residence? _____

20. Age _____

21. Formal education (years in school):

_____ 8 years or less
_____ 9-11 years
_____ 12 years
_____ 13-15 years
_____ 16 or more years

22. Number of children:

0-4 years	_____
5-12 years	_____
13-18 years	_____
Over 18 years	_____

23. What is your race?

_____White	_____Indian
_____Spanish-American	_____Black
_____Other (Please Specify)	

_____

THANKS FOR YOUR HELP!!

APPENDIX E

TABLE E1. ACTUAL RESIDENCE TYPE OF SURVEY RESPONDENTS[a] VS. PREFERRED TYPE OF RESIDENCE

Actual Residence Type	Residence Type Preferred						
	Single Family	Apartment	Condominium	Mobile Home	Trailer	Van	Total
Single Family	390	11	11	6	0	1	419
Apartment	24	10	2	2	1	0	39
Condominium	5	0	4	0	0	0	9
Mobile Home	98	3	2	30	1	0	134
Motel	4	0	0	0	0	0	4
Trailer	1	0	0	0	0	0	1
Van	0	0	0	0	0	0	0
Other	4	5	1	2	0	1	13
Total	526	29	20	40	2	2	619

[a]This data set does not include Hettinger County, North Dakota.

REFERENCES

Denver Research Institute. 1982. Facilitating Private Sector Capital Availability in Rapid Growth Communities. Prepared for Roy Romer, Treasurer, State of Colorado. Denver: University of Denver, Denver Research Institute.

Federal Energy Administration. 1977. A Report: Regional Profile--Energy Impacted Communities. Region VIII. Washington, D.C.: Federal Energy Administration, Socioeconomic Program Data Collection Office.

Gilmore, John S. 1976. "Boom Towns May Hinder Energy Resource Development." Science 191(1976):535-40.

Gilmore, John S. and Mary K. Duff. 1975. Boom Town Growth Management: A Case Study of Rock Springs--Green River, Wyoming. Boulder, Colorado: Westview Press.

Gilmore, John S., Diane Hammond, Keith Moore, Joel Johnson, and Dean Coddington. 1981. The Socioeconomic Impacts of Power Plants. Denver: Denver Research Institute.

Halstead, J. M. and F. L. Leistritz. 1983. Impacts of Energy Development on Mercer County, North Dakota. Agricultural Economics Report No. 170. Fargo: North Dakota State University.

Halstead, J. M.; F. L. Leistritz; D. G. Rice; D. M. Saxowsky; and R. A. Chase. 1982. Mitigating Socioeconomic Impacts of Nuclear Waste Repositories. Fargo: North Dakota State University.

Inter-Industry Technical Assistance Team (ITAT). 1983. Mercer County Socioeconomic Impact Mitigation Assessment. Volume XII. Beulah, North Dakota: ITAT.

Leistritz, F. L. and R. A. Chase. 1982. "Socioeconomic Impact Monitoring Systems: A Review and Evaluation." Journal of Environmental Management 15:333-49.

Leistritz, F. L.; J. M. Halstead; R. A. Chase; and S. H. Murdock. 1982. "Socioeconomic Impact Management: Program Design and Implementation Considerations." Minerals and the Environment 4(4):141-50.

Leistritz, F. L. and K. L. Maki. 1981. Socioeconomic Effects of Large-Scale Development Projects in Rural Areas: The Case of McLean County, North Dakota. Agricultural Economics Report No. 151. Fargo: North Dakota State University.

Leistritz, F. L.; S. H. Murdock; and A. G. Leholm. 1982. "Local Economic Changes Associated with Rapid Growth." In Coping with Rapid Growth in Rural Communities, Weber and Howell, eds. Boulder, Colorado: Westview Press.

Murdock, S. H.; J. DeMontel; F. L. Leistritz; P. Hopkins; and R. Hamm. 1981. An Analysis of the Construction Impacts of Coal Development in Rural Texas: The Case of Fayette County, Texas. Technical Report No. 81-2. College Station: Texas A&M University, Department of Rural Sociology.

Murdock, S. H. and F. L. Leistritz. 1979. Energy Development in the Western United States. Impact on Rural Areas. New York: Praeger Publishers.

National Institute for Socioeconomic Research. 1982. Colony/Battlement Mesa Socioeconomic Monitoring Report. Boulder, Colorado.

Prall, Les. 1983. Emery County. Central Utah Association of Governments. Telephone interview.

Smith, Ralph E. (ed.). 1979. The Subtle Revolution: Women at Work. Washington, D.C.: Urban Institute.

Texas Utilities. 1982. Unpublished data.

Thomas, John K.; Rita R. Hamm; and Steve H. Murdock. 1983. "The Socioeconomic Impacts of Repositories." In Nuclear Waste: Socioeconomic Dimensions of Long-Term Storage. Murdock, Leistritz, and Hamm, eds. Boulder, Colorado: Westview Press.

U.S. Department of Commerce, Bureau of the Census. 1982. Census of Population. Washington, D.C.: U.S. Government Printing Office.

_____. 1982. County Business Patterns 1981, North Dakota. Washington, D.C.: U.S. Government Printing Office.

_____. County Business Patterns 1980, Texas. Washington, D.C.: U.S. Government Printing Office.

_____. County Business Patterns 1981, Utah. Washington, D.C.: U.S. Government Printing Office.

_____. County Business Patterns 1981, Wyoming. Washington, D.C.: U.S. Government Printing Office.