Characteristics and Residential Patterns of Energy-Related Work Forces in the Northern Great Plains

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The socioeconomic characteristics of construction and operating work forces at energy related facilities in the Northern Great Plains were analyzed. A primary interest was to explain differences in local hire rates and settlement patterns on the basis of characteristics of the project and site area. In general, it was found that local hire rates for operating workers can be expected to be substantially greater than for construction workers when differences in project and site characteristics are taken into account. Nonlocal construction workers were found to live in larger communities and to commute substantially greater distances to the project site than nonlocal operating workers.

The continued growth in national energy needs and the failure of domestic oil and gas production to keep pace suggest that the composition of the nation's energy supply will undergo a substantial shift toward increased utilization of coal. As a result, the coal reserves of the Northern Great Plains Region, which includes Montana, Wyoming, and North and South Dakota, are expected to provide an increasing portion of the energy needed to meet growing national requirements. These four states account for 40 percent of the total United States coal reserves [U.S. Bureau of Mines, 1971]. Based on 1974 prices and technology, more than 80 billion tons of these reserves are economically strippable; this amount represents over 60 percent of the United States' strippable reserves [U.S. Bureau of Mines, 1974].

Future development plans for Northern Plains coal call for massive increases in mine-month generation of electric power, coal gasification, liquification, and export mining to meet growing energy needs. Coal production in the region increased from 16.3 million tons in 1970 to 66.7 million tons in 1976 [U.S. Bureau of Mines]. Production by 1985 is projected to exceed 440 million tons per year [Federal Energy Administration]. Likewise, electric generating capacity has increased from 1,960 megawatts in 1970 to 5,600 megawatts in 1976 with a projection of 13,650 megawatts by 1985 [National Coal Association].

One immediate effect of energy development is an increase in job opportunities and associated population growth. Rural areas of the Northern Great Plains have long experienced a lack of employment opportunities that has led to high levels of underemployment and out-migration [Voelker]. 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. In addition, it may lead to a large influx of persons from outside the area. For example, an influx of 1,500 construction workers and the associated population during the construction of an electric generating facility, and of nearly 500 permanent employees and their families during its operation, may affect many aspects of small rural communities [Toman, *et al.*] and may

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lead to population growth rates that pose substantial adjustment problems for communities in sparsely settled areas [Gilmore and Duff].

Planners who must attempt to prepare for such impacts are thus faced with a number of difficult tasks. These include not only estimation of the total impacts but also assessing both the specific local areas that are likely to provide workers for the project, and thereby stabilize their population bases, and those areas that will experience population increases due to the in-migration of new workers. Local planners have used a variety of mechanisms aimed at assessing the effects of factors such as worker characteristics, commuting patterns, community housing patterns, and community receptiveness on these two dimensions [Baldwin, *et al.*, Reiff, *et al.*]. The discernment of local labor availability rates and settlement patterns for new population, however, remain among the most difficult tasks in assessing local area impacts [Berkey, *et al.*].

This paper analyzes and compares the characteristics, local hiring rate, and settlement patterns of both construction and operating work forces at energy related facilities in the Northen Great Plains. Models are developed to explain differences in local hire rates and settlement patterns on the basis of project and site characteristics. The application of these models to impact projection at the community level is illustrated.

Methodology

The study area consisted of coal mine and electric generating plant sites in North Dakota, South Dakota, Montana and Wyoming. The data were obtained during the summers of 1974, 1975 and 1976 through the use of mail and self-administered questionnaires collected from all workers at the work sites.[1] Other data were made available by Mountain West Research, Inc. Although response rates varied widely (see Tables 1 and 2) largely because of differences in data collection methods which were in turn determined by levels of plant management cooperation, other analyses indicated no systematic bias between sites [Wieland, Leistritz, and Murdock; Leholm, *et al.* 1976].

In the analysis workers are denoted as local if they indicated that they did not move to take employment at the plant site and nonlocal or migrants if they did move to find employment. The variables used included community population in 1970, road mileage from residence to work site and from residence to the regional trade center, number of workers employed at each project, the number of workers employed at other energy work sites within a radius of 100 miles, and total population in the labor market area containing the work site.[2] Wage levels were as reported for 1974 by the Bureau of Economic Analysis (BEA) for the appropriate counties with the county wage level assumed to prevail in all cities in that county, and 1975 retail sales for communities were obtained from the North Dakota State Tax Department. These factors have been considered in several studies aimed at assessing the responses of rural populations to rural industrialization [Dobbs and Kiner; Lonsdale; Chalmers; Clemente and Summers] but had not been applied to analyzing both operating and construction work force patterns in the Northern Great Plains. As such, the methodology represents an extension of the work of other rural industrialization researchers [Dobbs and Kiner; Lonsdale; Clemente and Summers] into the analysis of the coal industry and an expansion of the work done on energy sites to include not only construction (Chalmers) but also operational workers.

[1]The survey procedures are described in detail in Leholm, *et al.*, (1975) Leholm, *et al.*, (1976); Wieland; and Wieland and Leistritz.

[2]The labor market area is defined as including all places from which it would be readily feasible to commute daily to work on a particular project. The commuting distance for construction workers was confined to within 100 miles of the construction site. The commuting region was confined to 40 miles for the operating work force.

TABLE 1. Summary of Powerplants and Coal Mines Surveyed, Year Surveyed, Number of Operating Employees, and Response Rate, 1974-1976

State and Site	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
Glen Harold 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 Co.)	1975	45	43	95.6
Montana				
Decker Mine (Peter Kiewit Sons, Inc.)	1975	280	114	40.7
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	794	56.5

Analysis

A comparison of key characteristics of the regional operating work force with the North Dakota construction work force reveals contrasts which affect community planning.[3] The average ages of the work forces were similar, with operating workers averaging 34.6 years and construction workers averaging 35.7 years of age. Almost 85 percent of the operating workers and 79.7 percent of the construction workers were high school graduates. A larger

[3]These comparisons (for example, between the regional operating and North Dakota construction forces) were made because some characteristics of construction workers outside North Dakota were not available. The regional operating work force consisted of all the coal mine and power plant permanent workers surveyed in the four-state area.

TABLE 2. Summary of Construction Sites Surveyed, Year Surveyed, Number of Construction Employees, and Response Rate, 1975

State and Site	Year Collected	Number of Employees	Number of Responses	Percent Response
North Dakota				
Leland Olds Power Plant #2 (Basin Electric Co-op)	1975	594	194	32.7
Square Butte Power Plant (Minnkota Power Co-op)	1975	500	73	14.6
UPA-CPA Power Plant (United Power Association-Cooperative Power Association)	1976	510	260	51.0
Subtotal		1,604	527	32.9
Montana				
Colstrip Power Plant (Montana Power Company)	1975	748	161	21.5
Wyoming				
Jim Bridger Power Plant (Pacific Power and Light)	1975	838	503	60.0
Texaco Lake Expansion (Texaco Oil Company)	1975	300	206	68.7
Sun Oil-Cordero Mine (Sun Oil Company)	1975	199	133	66.8
Texas Gulf Sulphur (Texas Gulf Sulphur)	1975	375	227	60.5
Subtotal		1,712	1,069	62.4
Total		4,064	1,757	43.2

percentage of the operating workers than construction workers were married, 82.7 percent compared to 73.6 percent, which provides a partial explanation for the larger average family size of the operating workers. Operating workers had an average family size of 3.40 while the construction workers' average family size was 2.47. One reason for the difference in family size is that many nonlocal construction workers did not bring their families with them into the site areas. Construction workers commuted an average of 33.6 miles (one way) daily while operating workers commuted an average of 21.9 miles. Of the 794 operating workers, 62.0 percent were local workers while 55.7 percent of the 519 construction workers were local workers.

Local Labor Availability Model

The local labor availability model is designed to estimate the number of workers that will be supplied by nearby communities to work on a given project. The objective in developing the local labor availability 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 in their labor market areas.

A review of rural labor market studies indicated that the following variables may be important in determining local hiring rates: community population, distance from residence to place of work, number employed at the given project, number employed at other energy or construction projects in the labor market area, total population of the labor market area, and the current wage level in the area [Dobbs and Kiner; Lonsdale; Chalmers; and Clemente and Summers].

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 a negative 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 all 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 a negative relationship between the community's wage level (WL_i) and the number of local workers that will be supplied to a project (LW_{ij}).

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

$$LW_{ij} = a_o + a_1POP_i + a_2D_{ij} + a_3EMP_j + a_4\Sigma EMP + a_5\Sigma POP + a_6WL_i$$

TABLE 3. A Comparison of Selected Worker Characteristics From the Regional Operating Work Force and the North Dakota Construction Work Force

Item	Regional Operating Work Force			North Dakota Construction Work Force		
	Total	Local	Nonlocal	Total	Local	Nonlocal
Total Number of Respondents	794	492	302	519	289	230
Average Age (Years)	34.61	35.89	32.52	35.74	35.66	35.84
Percent Married	82.69	83.15	81.94	73.61	74.70	72.24
Family Size[a]	3.40	3.52	3.37	2.47	2.65	2.24
Length of Residence (Months)	170.68	243.46	52.11	109.69	186.61	13.03
Percent High School Graduates	84.79	79.16	93.97	79.73	72.92	88.29
Commuting Distance (miles)	21.92	19.85	25.29	33.56	37.90	28.10

[a]Family size consisted of the workers and family members currently living with them in the community.

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 employees at other energy-related projects in the area; ΣPOP = the total population of all communities in the area; and WL_i = the wage level of community i.

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

Regional Operating Labor Availability Model

Data from all operating sites provided 54 observations on LW_{ij}. The empirical results are shown in the upper part of Table 4.

The coefficients on POP_i, EMP_j, and D_{ij} are significant at the .05 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 is shown below with the calculated t-ratios in parentheses.

$$LW_{ij} = 7.26000 + \underset{(4.66)}{.0018}\ POP_i - \underset{(-2.57)}{.5479}\ D_{ij} + \underset{(2.87)}{.1204}\ EMP_j\ ;$$

$$\text{F Value} = 11.21$$

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

Regional Construction Labor Availability Model

Data from the eight construction sites provided 72 observations on LW_{ij}. The results of the model are shown in the lower portion of Table 4.

The coefficient of determination is .443 for the equation, but only POP_i and D_{ij} are significant at the .05 level. Even so, hypothesized relationships existed for all the var-

TABLE 4. Results of Local Labor Availability Analysis for Operating and Construction Workers

Model	Variables	Variable Coefficients	t Values	Constant	F Value	R^2
Operating	Population	.0020	4.93**	1.2630	6.24**	0.443
	Distance	−.6324	−2.60*			
	Employment	.1551	3.17**			
	Total Area Employment	.0028	0.40			
	Total Area Population	.0007	−0.93			
	Wage Level	.0010	0.38			
Construction	Population	.0019	6.54**	12.0455	8.63**	0.443
	Distance	−.3451	−3.35**			
	Employment	.0138	1.31			
	Total Area Employment	−.0014	−0.10			
	Total Area Population	.00004	−0.37			
	Wage Level	.0011	0.76			

**Significant at .01 level.
*Significant at .05 level.

iables except ΣEMP. The best equation with all variables significant at the 10 percent level is:

$$LW_{ij} = \underset{}{15.1172} + \underset{(6.83)}{.0019\ POP_i} + \underset{(1.89)}{.0176\ EMP_j} - \underset{(-3.30)}{.3161\ D_{ij}} ;$$

$$\text{F Value} = 17.19$$

This equation had a coefficient of determination (R^2) of .431 and explained almost as much of the variance in LW_{ij} as the previous model. The hypothesized relationships existed for all three variables.

Summary of Local Labor Availability Models

Comparing the coefficients of the operating worker and construction worker labor availability models indicates that the local supply of workers is much more responsive to project employment for operating workers than for construction. A likely explanation is the temporary nature and specialized skills of construction jobs, whereas many energy companies use on-the-job training programs to impart needed skills to operating workers [Leholm, *et al.*, 1975]. The distance coefficient is much larger in the operating model than in the construction model, indicating that distance has a greater negative effect on the supply of workers for permanent jobs than for temporary construction jobs.

Residential Prediction Model

Once the number of local workers expected on a project has been estimated, the next steps are to determine the number of nonlocal workers required for the project and their likely settlement locations. The residential prediction model presented here represents an attempt to predict the community in which the new workers will choose to live within the commuting region of a given energy project. The model is based on the premise that the relative attractiveness of a community depends on its size and on its proximity to the project site and to the regional trade center.

The population of a community is an important factor in estimating community attractiveness 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. Larger communities offer more services and are more attractive places to live.[4] A positive relationship was hypothesized between a community's population and the number of nonlocal workers that will reside in that community.

The distance from the community to 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.

A community's distance from the regional trade center was hypothesized to be an important variable for this study area.[5] Since many of the project sites are located long distances from trade centers, it was hypothesized that the worker will maximize his utility by choosing a location that is within commuting distance of both his place of work and the regional trade center. This locational choice would minimize combined travel time to the job and to a trade center.

[4]At higher population levels this relationship may not hold true. For example, a community of 1,000,000 people may not be more desirable than a community of 100,000.

[5]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, and (14) Camera Shop; or $11 million annually in retail sales and at least six of the above retail functions. Their classification was used in this analysis.

Summarizing, the attractiveness of an individual community can be stated as:[6]

$$A_i = \frac{POP_i^{\beta_i}}{D_{ij}^{\beta_j}\ D_{it}^{\beta_t}}$$

Where: A_i = the attractiveness of the *ith* community; POP_i = population of community i; β_i = the population elasticity coefficient which measures the responsiveness of nonlocal workers with respect to community population; 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; and 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 basic 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) reflects the attractiveness of community X (A_X) relative to community Y (A_Y). Specifically:

$$\frac{NL_X}{NL_Y} = \frac{A_X}{A_Y} \text{ or } \frac{NL_X}{NL_Y} = \frac{POP_X^{\beta_i} / D_{Xj}^{\beta_j}\ D_{Xt}^{\beta_t}}{POP_Y^{\beta_i} / D_{Yj}^{\beta_i}\ D_{Yt}^{\beta_t}}$$

Ordinary least squares can be used to estimate the distance elasticities (β_j and β_t) once the above equation is made linear through logarithmic transformations.[7] Observations consisted of every possible pair of communities within the commuting region of a project site.

Model Results

Data from the 14 operating sites provided 71 observations for estimating the regional operating model and data from eight construction sites provided 216 observations for the construction model. The regression results for these models are shown in the top part of Table 5. An examination of the data in Table 5 clearly reveals that in all cases a substantial proportion of the variation in settlement patterns was explained, thereby indicating the general validity of the model. At the same time, however, a comparison of the models without the trade center factor to those with it suggests that the trade center factor adds relatively little additional explanatory power to the model. In sum, then, the general model appears quite good for both construction and operating workers but is not improved significantly by adding the trade center factor.[8]

An Alternative Measure of Community Attractiveness

As noted above, population is the variable most frequently used in gravity models to measure community attractiveness. The primary reason appears to be the general availability of population data at the community level. An alternative measure of community attractiveness is retail sales volume which di-

[6]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.

[7]The distance elasticities indicate the percentage change in the proportions of workers for a given community pair that occurs with each percentage change in distance (i.e., from the project site or from the regional trade center).

[8]The conclusion regarding the contribution of the regional trade center variable differs from that reported by Murdock, *et al.* However, the results of the two analyses are not directly comparable because of difference in model specification.

TABLE 5. Results of Residential Prediction Models for Operating and Construction Workers

Model	Variables	Variable Coefficients	t Values	R^2
Operating with Distance to Trade Center	Population	0.609	4.80**	0.695
	Distance to site	0.602	3.94**	
	Distance to trade center	0.244	1.85	
Operating without Distance to Trade Center	Population	0.452	4.72**	0.679
	Distance to site	0.656	4.30**	
Construction with Distance to Trade Center	Population	0.679	8.86**	0.717
	Distance to site	0.587	6.47**	
	Distance to trade center	0.091	1.30	
Construction without Distance to Trade Center	Population	0.612	10.86**	0.715
	Distance to site	0.598	6.61**	
North Dakota Model Using Population as Community Attraction Measure	Population	0.655	5.9 **	0.893
	Distance to site	1.071	10.3 **	
	Distance to trade center	0.154	1.4	
North Dakota Model Using Retail Sales as Community Attraction Measure	Retail Sales	0.773	17.9 **	0.940
	Distance to site	0.974	10.9 **	
	Distance to trade center	0.181	2.5*	

**Significant at 0.01 level.
*Significant at 0.05 level.

rectly measures the activity of the local trade and services sector and also may be a useful indicator of the availability of other services and amenities. Data on retail sales volume were available at the community level only for 93 observations in North Dakota. Substitution of total retail sales (TRS) for population in the construction model (for North Dakota sites only) gives the results shown in the bottom portion of Table 5.

The results shown in Table 5 indicate that retail sales may be a better measure of community attractiveness than population, at least for construction workers at the North Dakota sites surveyed. These results suggest that experimentation with measures of community attractiveness other than population may result in more accurate estimates of residential choice. However, data limitations will restrict the choice of variables.

Summary of Residential Prediction Models

The results of both the operating and construction models seem satisfactory in terms of overall explanatory value. In both cases, exclusion of the variable D_{it} did not substantially affect the overall predictive ability of the models. The models with POP and D_{ij} reveal that distance is less important for construction workers than operating workers, and community size is more important to construction workers.

Applicability of the Results

The best way to explain how the models might be used is through the use of a hypothetical illustration. Assume that construction of a 1,000 megawatt power plant is proposed in an area where there are three communities of varying sizes within the commuting area (Figure 1). Community C is the regional trade center for the area.

Assuming that 1,500 construction workers will be required on the project, the number of local workers that will be employed from three communities can be determined using the local labor availability model:

$$LW_a = 15.1172 + .0019\ (POP,\ 1{,}500) - .3161\ (D,\ 20) + .0176\ (EMP,\ 1{,}500)$$

$$LW_b = 15.1172 + .0019\ (800) - .3161\ (5) + .0176\ (1{,}500)$$

$$LW_c = 15.1172 + .0019\ (40{,}000) - .3161\ (40) + .0176\ (1{,}500)$$

$$LW_a = 38 \qquad LW_b = 41 \qquad LW_c = 105$$

The total number of nonlocal workers can then be determined by subtracting the local workers from the total needed on the construction project, thus 1,500 minus 184 or 1,316 nonlocal workers will be required. Using the construction worker residential choice model, $A_i = \frac{POP^{.612}}{D_{ij}^{.598}}$, one can determine where the nonlocal workers will reside:

$$A_a = \frac{1{,}500^{.612}}{20^{.598}} = 14.65$$

$$A_b = \frac{800^{.612}}{5^{.598}} = 22.84$$

$$A_c = \frac{40{,}000^{.612}}{40^{.598}} = 72.18$$

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

	Allocation Factor
Community A	.1336
Community B	.2081
Community C	.6582

Taking the allocation factors times the 1,316 nonlocal workers, 176 workers will reside in Community A, 274 in B, and 866 in Community C.

Once construction is finished, operating workers will be needed at the plant and associated mine. For a 1,000 megawatt power plant and associated coal mine, approximately 500 operating workers would be required. Using the coefficients in the operating local labor availability model, Community A will supply 59 workers; B, 66; and Community C, 118. The number of nonlocal workers that will be required is 500 minus 243 or 257 workers. Using the coefficients from the operating worker residential choice model, 45 of the nonlocal workers will reside in Community A, 85 in Community B, and 127 in Community C.

The impact on one community, say Community B, could be estimated by examining characteristics of past energy related work forces (shown previously in Table 3). During the construction phase it was estimated that 274 new workers would reside in Community B. With the average family size at 2.24 people per worker (Table 3), a total of 614 new residents could be expected to be living in Community B. This includes the construction workers and their wives and children. For the operating (permanent) work force, 85 nonlocal workers would be expected to reside in Community B. The average family size of nonlocal workers was 3.37 (Table 3), thus 286 workers and dependents would be expected to reside in Community B. These hypothetical projections include direct workers only; the subject of indirect employment is not discussed in this article.

Summary and Conclusions

This paper has compared the characteristics of construction and operating work forces at energy related facilities in the Northern Great Plains. A primary interest was to explain differences in local hire rates and settlement patterns on the basis of characteristics of the project and of the site area. Models were developed which explained more than 40 percent of the variation in local hire rates for both construction and operating workers and more than two-thirds of the variation in settlement patterns for both worker types. A community's population and its proximity to the project site were found to be key variables in both the local hire and the residential prediction models. In general, the results showed that local hire rates for operating workers are substantially greater than for construction workers when differences in project and site area characteristics are taken into account. Nonlocal construction workers were found to live in larger communities and to commute substantially greater distances to the project site than nonlocal operating workers.

Overall, then, the study represents an important first step toward analyzing the effects of various factors on the local hiring rate and on settlement pattern choices. It suggests that many of the standard mechanisms historically used in predicting these patterns are applicable to rural energy development sites in the Plains. At the same time, however, they suggest the need for much additional work particularly in the assessment of factors affecting local hiring levels. Thus, the need to develop more effective measures of such factors as underemployment in rural areas and to investigate the use of such factors as levels of education and other skill level indicators represent areas where additional research effort is both necessary and promising.

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