

**Coal, Water and Related Land Resources  
Development in Southwestern  
North Dakota**

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**COAL, WATER AND RELATED  
LAND RESOURCES DEVELOPMENT  
IN SOUTHWESTERN NORTH DAKOTA**

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COAL, WATER AND RELATED LAND RESOURCES  
DEVELOPMENT IN SOUTHWESTERN NORTH DAKOTA

By

Gene C. Griffin

The purpose of my appearance here today is to disseminate information and ideas which, hopefully, will be of some value to you in formulating an opinion of your own concerning development of the coal, water and related land resources of southwestern North Dakota. Throughout the presentation I will attempt to limit the offering of my own personal opinion. I think that an issue as complex as the one which is being addressed at this symposium should be treated with a great deal of objectivity, and offering of my opinion would only have the effect of reducing the degree of objectivity which might possibly prevail. Opinions are very easy to come by, each and every one of us has an abundance of them. It is more difficult, however, to obtain factual information and relevant ideas to guide us in the formulation of an opinion or in reaching a decision.

To begin with I would like to speak about the decision making process as I view it. Before the decision making process can take place it is necessary to establish goals and objectives. For instance, economic growth has been an established goal of this country since the depression of the 1930's. Many decisions regarding public investment have been based on the effects such expenditures will have on economic growth. Public investment expenditures in the past have been funneled into activities which would enhance economic growth in the United States. Only recently has this particular goal been questioned in terms of its conflict with the recent emergence of the goal of providing for a certain level of environmental quality in the United States. The establishment of goals provides direction for various expenditures and corresponding productive activities. Establishment

of goals also enables us to gauge the contributions and successes that proposed and implemented activities and investments will make towards achieving such goals.

Therefore, it is meaningless to attempt to answer the question, "Should coal be mined in southwestern North Dakota?," if goals for the area in particular, and the state and nation have not been established. Examples of some goals could consist of increased economic activity, preservation of the existing environment, increase in personal income for those currently earning less than a given figure, increasing the availability of public recreation facilities, etc.

Once goals have been established a decision making process can take place. The decision making process is more important than the decision itself, for if the process is faulty, then necessarily the decision will more than likely not be consistent with goals one has established. Essentially a decision making scheme should consist of four separate but yet interrelated activities. The first activity should consist of obtaining information and data concerning the subject being considered. Information and data should be both relevant and objective. Secondly, the data should be subjected to some form of analysis, either formal or informal. The analysis should be performed without the influence of some preconceived notion as to what the final decision should be, i.e., analyze the data as though you were not concerned about the outcome of the decision. The third step is to reach a decision based on the goals which were previously formulated. The last step in the process involves the human element, that is the subjecting of your decision to your value judgments.

Defining the term negatively a value judgment is reaching a decision which is not based on sound scientific objectivity. Value judgments can be described as your attitude or opinion towards nonmeasurable elements of life. A decision based on personal tastes, preferences, emotions and inherited traditions, such as the beauty of a picture, can be said to be based on value judgments.

As an example of the process, let us look at the current issue. Assume that stabilizing or increasing employment in the area is a goal consistent with society's preferences for southwestern North Dakota. The first step in the process would be to collect information regarding the effect of coal development on employment. Secondly, we would analyze this information; e.g., is the new employment significant relevant to current employment? If coal development did significantly enhance employment in the area we would reach the conclusion that such development was consistent with our goals and decide in favor of such development. However, one must now subject their decision to their value judgments. If, for instance, you felt that coal mining, in general, severely degraded the aesthetic value of the landscape, a conflict between the goal of increasing or stabilizing employment and the value judgment arises. Many such conflicts surround the current issue.

Given that one has established goals and a method for formulating an opinion it is necessary to be informed about the subject. A historical picture of population and employment of the area gives some insight into past economic activity.

The population of southwestern North Dakota has been decreasing during the last thirty years, from 103,495 in 1940 to 86,184 in 1970 (Table 1). North Dakota as a state has experienced similar changes in population with an overall decline of more than 24,000 in the last thirty years. Adams, Bowman, Hettinger and Slope counties have also

experienced an overall decline in population over the last thirty years (Table 1). The population losses in the state, area and respective counties can be directly attributed to out-migration. North Dakota and southwestern North Dakota experienced a net out-migration of 15.0 percent and 21.2 percent, respectively in the 1960-70 decade (Table 2). Much of the population decline and certainly the net out-migration can be attributed to lack of employment opportunity in the area.

Year	North Dakota	West River Area	Adams County	Bowman County	Hettinger County	Slope County
1940	641,935	103,495	4,644	3,860	7,457	2,932
1950	619,636	95,682	4,910	4,001	7,100	2,315
1960	632,446	93,840	4,449	4,154	6,317	1,893
1970	617,761	86,184	3,832	3,901	5,075	1,484

**SOURCE:** United States Census of Populations: Bureau of the Census, United States Department of Commerce.

	Population Change 1960-1970	Births 1960-1970 <sup>1</sup>	Deaths 1960-1970 <sup>1</sup>	Net Migration 1960-1970	Rate of Net Migration 1960-1970
North Dakota	-14,685	135,293	55,107	-94,871	-15.0
Southwestern North Dakota	-7,656	19,857	7,649	-19,864	-21.2
Adams	-617	819	390	-1,046	-23.5
Bowman	-253	812	407	-658	-15.8
Hettinger	-1,242	1,239	486	-1,995	-31.6
Slope	-409	382	148	-643	-34.0

<sup>1</sup>**SOURCE:** North Dakota State Department of Health, Bismarck, North Dakota.

Employment in southwestern North Dakota is in a similar situation experiencing a decline of nearly 5,000 since 1950 (Table 3). The development of coal resources will probably stabilize or increase population and employment in southwestern North Dakota and the state.

<b>TABLE 3. EMPLOYMENT BY BROAD INDUSTRIAL SECTOR FOR THE WEST RIVER AREA.</b>				
<b>Industrial Sector</b>	<b>1940</b>	<b>1950</b>	<b>1960</b>	<b>1970</b>
Agriculture	18,634	18,114	14,099	9,141
Mining	436	323	559	494
Contract Construction	335	1,438	1,212	1,528
Manufacturing	490	650	996	1,113
Transportation, Communication & Public Utility	1,115	1,799	1,523	1,687
Wholesale and Retail Trade	2,944	4,696	5,368	5,601
Finance, Insurance, and Real Estate	277	380	651	740
Services	3,941	4,078	5,070	6,753
Government	1,041	1,212	1,536	1,435
Other	193	591	443	N.A.
<b>TOTAL</b>	<b>29,406</b>	<b>33,281</b>	<b>31,457</b>	<b>28,492</b>

**SOURCE:** Bureau of Economic Analysis, United States Department of Commerce, Washington, D.C.

Estimates of employment per plant for gasification vary. However, there is general agreement that approximately 700 jobs would be created by a 250 MMSCF/D plant and an additional 300 employees would be required to mine and process the necessary coal (Table 4). The employment requirements for steam electric power generation have been estimated at 50 plant employees and 55 mine employees for a 500 megawatt plant.



The employment generated by either a gasification plant or a steam electric generating facility would create an additional indirect employment of a supporting nature. The exact nature and size of the employment multiplier is not known, the best estimates at this time is an average employment multiplier of 3.24. Every job in a plant or mine for instance will create an additional 2.24 jobs. It is unlikely that all jobs will exist in the area of the plant however, they will be distributed among the area and the state. Settlement patterns will definitely affect the location of employment opportunities and corresponding population (Table 4).

<b>TABLE 4. ESTIMATED EMPLOYMENT AND POPULATION IMPACT OF COAL DEVELOPMENT.</b>		
	<b>250 MMSCF/D Gasification Plant</b>	<b>50 Megawatt Generating Plant</b>
<b>Direct Employment:</b>		
Plant	700	50
Mine	300	55
<b>Indirect Employment</b>	<b>2,240</b>	<b>235</b>
<b>Total Employment</b>	<b>3,240</b>	<b>340</b>

Total population changes which will be associated with increased employment are estimated at a ratio of 2.7 to 1.0. Thus, for every new job added, a population increase of nearly three can be expected. It should be noted that these employment and population multipliers do not take into account the possibility of spin-off industries located in the area. They also do not state that all of the increased population and corresponding employment will be located in the vicinity of the development.

Although increased employment and, consequently, population will be created by the conversion of coal, it will also require the use of coal, water and related land resources. Estimates of water requirements for gasification and electric generation vary according to

company and the technology utilized for cooling, respectively (Table 5). Annual coal requirements for gasification and steam electric power generation would total 10,000,000 tons and 3,000 tons, respectively. Associated land requirements, based on a fourteen foot average seam and 90 percent recovery rate would amount to 460 and 140 acres for gasification and electric generation, respectively (Table 5).

<b>TABLE 5. ESTIMATES OF ANNUAL COAL, WATER AND RELATED LAND REQUIREMENTS.</b>	
<b>Water Requirements:</b>	
<b>Gasification (250 MMSCF/D)</b>	
Michigan-Wisconsin Request	17,000 A.F./Yr.
Natural Gas Pipeline Co.	10,000 A.F./Yr.
El Paso Gas Co.	9,417 A.F./Yr.
<b>Steam Electric Power (500 MW)</b>	
Wet Cooling Tower	7,950 A.F./Yr.
Cooling Ponds	5,800 A.F./Yr.
Dry Cooling Tower	700 A.F./Yr.
<b>Coal Requirements:</b>	
Gasification	10,000,000 tons
Steam Electric Power	3,000,000 tons
<b>Land Requirements:<sup>2</sup></b>	
Gasification	460 acres
Steam Electric Power	140 Acres

<sup>2</sup>Based on a 90 percent recovery rate, 14' average thickness of coal seam and 1,730 tons per acre foot.

With increased population one must expect some impacts on the existing social, economic, and political system including transportation. Impacts on transportation will probably be most notable in the area of the existing road and highway system of the area. The impact will be evident in two forms, that of new investment in the construction of

new streets, highways and roads including rebuilding of existing facilities, and increased maintenance costs for new and existing facilities. The exact nature of the impact will depend on the level of development and the settlement patterns associated with the development.

There will also be an impact on the public transportation system of the area. For instance, Dickinson may become viable as a public airport for the common carrier with established flights. Similarly, the potential for a rural transportation system which would serve the existing population as well as the expected in-migrating population is enhanced.

One area of potential impact which has not been publicized to any great degree is in the are of spin-off industries associated with the by-products from a gasification plant (Table 6). It has been estimated that one gasification plant will produce 435,523 pounds of nitrogen daily in the form of ammonia. This would amount to 79,118 tons annually, enough to cover 5,274,000 acres at a rate of thirty pounds per acre. Plastics is another potential spin-off industry since phenols are one of the necessary materials used in the production of plastics.

<b>TABLE 6. ESTIMATED BY-PRODUCTS FROM A 288 MMSCF/D GASIFICATION PLANT.</b>	
<b>By-Product</b>	<b>Quantity</b>
Tar	239,250 gal/day
Tar Oil	157,370 gal/day
Naphtha	74,900 gal/day
Crude Phenol	32,470 gal/day
Sulphur	167 l.t./day
Ammonia Solution	332,550 gal/day

**SOURCE:** El Paso Natural Gas Company (Mexico Plant).

Given that this is only a minute portion of the information that exists which can be used in formulating an opinion, I believe that whatever development eventually takes place will depend largely on basic attitudes (and the level which government influence will take place). The attitude towards natural resources such as coal, water, land, etc., can be categorized in three ways, (1) exploitation, (2) preservation, or (3) conversation.

Exploitation / \_\_\_\_\_ / Preservation Conservation

This country has seen efforts to affect our resources in all three ways, starting with exploitation in the early history of our country up until present days. Preservation, on the other hand, has only recently gained much momentum. Conversation has been a prominent attitude since the days of independence.

The level of government influence will in all likelihood be the determining factor in the level of development of the area of coal resources. It is my opinion that federal government influence concerning the development of western coal will be of significant magnitude. President Ford, in his speech to the nation concerning inflation on October 8, 1975 made reference to the utilization of coal in general in several statements.

The following are two of those statements:

- (1) "New legislation will be sought after your recess (Congress) to require use of cleaner coal processes and nuclear fuel in new electric plants, and the quick conversion of existing oil plants. I propose that we, together, set a target date of 1980 for eliminating oil-fired plants from the nation's base-loaded electrical capacity."
- (2) "For the long range, we must work harder on coal gasification."

The higher the level of government influence, the less the people of the area will be able to influence the outcome. If the national government views coal development as an important step in solving our current energy crisis and, consequently, our economic problems, it is very difficult to imagine state or local government being able to influence the level of development. However, they may be able to affect to a considerable degree how the development takes place.

In closing, I would like to offer one final opinion. The development of western coal has been treated as though the only use for such resources is in the area of energy conversion. However, coal can be utilized in the production of several products including plastics, pharmaceutical products, dyes, solvents, epoxy coatings, saccharine and fertilizer. This is just the chemical feasibility and does not in any way refer to the economic feasibility of such production.

Such possibilities for the use of the coal should be researched, for a possibility exists that other uses may be environmentally more capatible, economically more desirable, and socially more acceptable. I do not personally feel that the use of coal for energy conversion should be banned. On the other hand, diversification of the use of coal could be as important to the area and state as diversification of the agriculture industry and as important as diversification is to the individual farm or ranch manager.