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Economic impact of Resource 89 on Great Falls, Montana

Margaret Sogard
The University of Montana

THE ECONOMIC IMPACT OF RESOURCE 89
ON GREAT FALLS, MONTANA

By

Margaret Sogard

B.A., University of Montana, 1968

M.A., University of Colorado, 1971

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Approved by:

Chairman, Board of Examiners

Dean, Graduate School

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I. INTRODUCTION

Purpose

As the U. S. strives for energy independence, western resources will play an increasing role in supplying this country's energy needs. Since the early 1970's energy-related development has mushroomed in the West, primarily in sparsely populated areas which have been greatly changed as a result of energy-related growth. Because of the negative impact of energy development on many communities, there has been a great deal of interest in attempting to assess not only the environmental impact of energy projects, but also the social and economic changes that are likely to occur in nearby communities as a result of such development.

Predicting changes in the economic base of a community such as those associated with a major energy project is necessary in order to implement local planning. Communities may wish to control local development or to accelerate it through positive actions, such as the issuance of revenue bonds to subsidize industry or the initiation of special vocational training programs to take advantage of additional job opportunities. Whatever the reason, accurate predictions of local employment impacts are the basis for estimating changes that will be needed in the infrastructure of the community and the revenue flows needed to make those changes.

Despite its position as Montana's second largest city and as the regional trade center for North Central Montana, Great Falls is currently experiencing problems associated with changes in the city's economic base. A manpower realignment at Malmstrom Air Force Base will result in the direct loss of 900 military and 50 civilian jobs by 1982. In September of 1980 the Anaconda Company announced the immediate closure of its copper refinery in Great Falls, eliminating approximately 500 jobs from the city's economic base.

As a result, the city of Great Falls has undertaken an active economic development program aimed at increasing and diversifying the city's economy. One goal of this program is to attract energy development to the area. The city has been actively promoting this location as a site for Resource 89, a 350 megawatt coal-fired electrical generating plant proposed for construction in the mid-1980's by the Montana Power Company.

Among the various criteria used by utilities in selecting a site are the cost to the utility, the cost to the local community in terms of social and economic impacts, environmental considerations and engineering factors. An optimal site exists for each of these criteria, but usually no single site can equally satisfy all of them. Therefore, trade-offs must be made in deciding on a location. However, one factor that is gaining increasing acceptability is the siting of facilities where they will have the least adverse economic and social impacts and result in the least disruption in lifestyles for residents of the affected community.

The proposal to build a major facility so near a regional population center is unique. Many in Great Falls view the prospect of Resource 89 from the perspective of the effect of energy development on smaller communities and look to it as a potential solution to the city's economic problems.

The purpose of this paper is to assess some aspects of the economic impact of Resource 89 on Great Falls should a nearby site be selected. In order for the community to sensibly plan for the future, those in positions of responsibility must have as accurate information as possible about the potential impact of such a project in order to avoid miscalculations about its relative importance.

Scope

Most impact studies are the combined efforts of many experts from numerous disciplines. Should a site near Great Falls be selected as the location for Resource 89, a comprehensive impact study would be mandated by state law. This paper is neither an attempt to preempt or duplicate that study. Rather it will attempt to forecast with as much accuracy as possible, given the information currently available, the effect of both the operating and construction phases of Resource 89 on population, earnings, employment, schools and housing, given the information available at this time. Since this research was done five years before construction is slated to begin, it is very likely that unforseen changes may occur that will affect the capacity of the community to absorb the impact of Resource 89 or that changes in the project itself may alter the expected workforce. Hence, the reader should take care to be aware of such changes and how they may alter the results of this research effort.

Methodology

In attempting to analyze the impact of such a project, it is necessary to know specific information not only about the project itself and the communities it will affect, but also some general information about construction workers' habits and life styles. Some information is now available as a result of a series of surveys of construction workers and new residents in communities experiencing energy development. These surveys were done for the Old West Regional Commission with the expressed purpose of providing other communities about to experience large construction projects with some tools for analyzing the probable impacts.[1] This paper has applied the models developed from those surveys to the Great Falls area. Data supplied by the Montana Power Company about Resource 89 has been used to analyze the probable population related impact of the construction phase. More traditional multiplier analysis has been used to forecast the probable effects on earnings and employment.

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[1]Mountain West Research, Inc., Construction Worker Profile: Final Report, (Billings, MT: for the Old West Regional Commission, December 1975).

II. ENERGY IN THE U. S.

An Overview

In 1978 total energy production in the U. S. was three percent less than that produced in 1972. Yet, in that same period energy consumption rose 9 percent. The difference was made up by oil imports which now account for one-half the oil consumed in the U. S.[1]

The energy problem in the U. S. does not arise from a scarcity of resources. Several plausible options for an indefinitely sustainable energy supply do exist. The problem lies in affecting a smooth transition from gradually depleting resources of oil and gas to new technologies whose potentials are not yet fully known and whose costs are currently unpredictable.

The most critical near term problem for the U. S. is the supply of oil and gas. It is widely predicted that beginning in the 1980's world supplies will be severely strained due to the expectation of peaking in world production in the 1990's and increasing demand from the Third World. However, several problems could occur earlier because of the actions of OPEC or political disruptions in the Middle East.

According to the Secretary's Annual Report to Congress in January, 1980, the U. S. Department of Energy (DOE) is planning for a three-phase

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[1]National Research Council, National Academy of Sciences, Energy in Transition 1985-2010, (San Fransisco: W. H. Freeman & Co., 1979), p. 1.

transition in energy use.[2] Between 1980-85 the U. S. will continue to rely on oil as its primary source of energy. The emphasis will be on reducing demand through conservation and increased efficiency. During the period from 1985 until the year 2000 the U. S. will move away from oil and begin diversification into coal, coal-derived synthetics, oil shale and new nuclear technologies. During this transition period coal and nuclear power appear to be the only large-scale alternatives and both are best suited to the generation of electrical power. After the year 2000 the DOE foresees a move toward renewable energy resources and advanced nuclear technologies. Both coal and uranium resources offer the U. S. assurances of an adequate energy supply long into the future, if one assumes the successful development of benign technologies for converting coal to gas and liquids and for extracting more useful energy from uranium than is possible with current technologies. However, the U. S. has no domestic experience with commercial-sized plants for these technologies and thus, no reliable cost estimates.

Electrical Power

In 1979 total electrical consumption in the U. S. grew by three percent to a total of 2.1 trillion kilowatt hours, with industrial use accounting for 40 percent, commercial use 23 percent, and residential use 33 percent.[3] The usefulness of electricity has grown rather than diminished in recent years. Electric motors, modern lighting, radio, TV, and now the developing importance of computers have made electricity

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[2] U.S., Department of Energy, Secretary's Annual Report to Congress, (Washington: January 1980), p. 2.

[3] Ibid., p. 2.

indispensible to modern industrialized society. Electrical consumption now makes up approximately 30 percent of total fuel consumption and is expected to increase. The DOE predicts increases in electrical use ranging from 3 to 4.6 percent per year until the end of this century.[4]

Edison Electric Institute research confirms that there is currently ample generating capacity in the U. S. on a local level. However, there are questions about the adequacy of reserve margins in some areas. If supplies do not increase, there are likely to be electrical shortages in some areas beginning in the 1980's even if demand grows more slowly than anticipated.[5]

Sources of Future Electricity

Renewable Resources

Hydro

Further exploitation of hydropower has been largely ruled out as a significant future incremental energy resource. Most of the best sites have already been used. While it might be possible to expand some hydroelectric plants at existing sites and even to build some new generating facilities, a major program to expand electrical production by building large new dams would run into environmental opposition because of its effects on stream ecology and land use.

Solar

Because of its higher economic costs solar energy will probably

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[4] Ibid., p. 2.

[5] Thompson, W. Reid, "Preparing for the Future in Electric Power," Public Utilities Fortnightly, April 12, 1979, p. 19.

not contribute more than five percent to our energy supply in this century. While sunlight carries more potential than any other renewable resource, its future will depend heavily on the equipment needed to put it to use. Applications of solar technology for space heating and hot water appear to have near term potential for broad use. However, because solar energy is a relatively diffuse source, a large system for collecting it is required, and can be expensive. Storage is necessary if completely independent systems are to supply peak winter heating needs. This too is expensive. According to one study, active household solar energy systems would not be generally competitive unless crude oil prices were to reach the equivalent of $35 per barrel in 1975 dollars.[6] Unless there is a breakthrough in the use of cheaper materials, home solar heating systems will only be able to compete with most future technologies if solar heating is assigned a social benefit not reflected in monetary costs.

Indefinitely Sustainable Energy Resources

Several energy sources offer the potential for an almost indefinitely sustainable energy supply. They include controlled thermonuclear fusion, nuclear fission with breeding, solar energy and geothermal energy. Each could supply up to ten times our present energy requirements for thousands of years. However, they all differ widely in readiness for use, in probable side effects and in economics. In fact, present knowledge is insufficient for any meaningful comparison. While not indefinitely sustainable, synthetic oil and gas from coal and oil shale hold real possibilities for meeting long-term energy needs.

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[6] Sam Schnurr, et al., Energy in America's Future: The Choices Before Us, (Baltimore: Johns Hopkins University Press, 1979), p. 30.

No technology shows more potential than nuclear power for long-run supplies of electricity at reasonable costs. Unfortunately, no other technology poses such complex issues of public policy. Prospects for nuclear power have deteriorated recently despite the rising costs of fossil fuels and concerns about the environmental consequences of using coal. Estimates of installed nuclear capacity by the end of the century have fallen sharply, largely the result of significant doubt as to whether nuclear power will ever prove acceptable to the American public.

Expanding the international use of nuclear fuels in a civilian power industry could lead to a proliferation of nuclear weapons capability among many countries, thereby increasing the likelihood of nuclear accident and even nuclear war. This is particularly a problem with the breeder reactor which will depend on recovering and reprocessing fissionable plutonium. However, it is primarily the breeder reactor which could dramatically expand the life expectancy of uranium in meeting energy needs. New technology holds the possibility of breeding new fissionable fuel from the uranium 238 component of natural uranium which is 140 times more abundant than the component occurring as naturally fissionable uranium 235. Development of the breeder reactor would also reduce the raw fuel component to a negligible element of cost in nuclear power and could free nuclear electrical production from cost increases arising from resource depletion.

Coal

Coal is this nation's most abundant fossil fuel. Domestic recoverable reserves amount to 6,000 quads, part of a total domestic resource of about 80,000 quads.[7] Current consumption is approximately 14 quads per

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[7]A quad is a quantity of energy equal to 10^{15} British thermal units.

year or less than 0.3 percent of domestic recoverable coal reserves.[8]

Substitution of coal for natural gas and oil particularly in the generation of electricity would seem a ready-made solution to the nation's energy problems. Coal use is, however, limited not by lack of production capacity, but by the difficulties of burning it in an environmentally safe and economically competitive manner. Today coal is only economically and environmentally suited for use in very large installations such as utility power plants and large industrial boilers. Current DOE regulations under the Power Plant and Industrial Fuel Use Act of 1978 are designed to halt the use of oil and natural gas in new power plants and large industrial heating units, thus encouraging their conversion to coal.

However, problems with coal use may preclude it as a mainstay of U. S. energy production over the long run. The environmental costs of coal remain high. Mining and burning two or three times the present output of coal will be extremely difficult without increasing its contribution to air and water pollution, as well as land degradation. The problem of acid rains and the possibility of world-wide changes in climate due to the cumulative buildup of carbon dioxide in the atmosphere over a long period of time are two very real problems associated with the increasing use of coal. Safety is another. The Office of Technology Assessment has estimated that fatalities per plant year for the entire chain of operations, beginning at the coal mine, range from 1 to 14. The range for uclear power is 0.2 to 3.[9]

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[8] National Academy of Sciences, Energy in Transition, p. 19.

[9] Sam Schnurr, et al., Energy in America's Future, p. 36.

Regardless of the development of other energy sources, coal will doubtless remain a key element in U. S. energy policy beyond the end of this century. Because of its ready availability, it will no doubt be used to make up for delays in the development of other energy resources. Demand rather than supply is thought to be the key factor in coal use.

Research by the National Academy of Sciences leads to the prediction that coal will provide one-third to one-half of the nation's energy needs or about 45 quads by the year 2000.[10] That study concludes that coal must be used in increasing quantities and mainly with current technologies until at least 2000 regardless of what happens with alternatives.

This is particularly true in Montana. With large deposits of relatively inexpensive strippable coal and an initiative passed by the voters banning construction of nuclear plants in the state, coal-fired generating units, appear, in the short run, to be the only solution for meeting increasing demand for electrical energy.

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[10] Energy in Transition, p. 24.

III. SOCIOECONOMIC IMPACT STUDIES

Energy facilities typically employ large amounts of labor, capital and material in extracting and converting resources to energy. Traditionally this infusion of new activity has been used as a lever to increase local employment, to add to local incomes and to reverse historic patterns of out-migration and declines in productive populations.

However, for many areas the experience of the 1970's was that the economic stimulus of energy development created a condition of too rapid employment and population growth which eroded rather than improved the fabric of the community. The construction of a new facility often created too many new jobs too quickly to be filled by local workers. The promise of jobs drew a temporary in-migration of new workers and their families who relied on the host community for public health, safety, education and recreational services. Thus demand for community services increased at a time when for many communities, sources of community revenue to expand them were lacking. For example, as a direct result of energy and resource development in Sweetwater County, Wyoming the population rose from 18,000 to 37,000 between 1970-74 as 8,000 new jobs were created. During this period the county experienced a shortage of 124 classrooms, an 800 percent increase in mental health caseloads, a 200 percent increase in the patient/doctor ratio, a 60 percent rise in crime and a shortage of 1,400 homes.[1]

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[1]Erik J. Stenejhem, Summary Description of SEAM, The Social and Economic Assessment Model, Energy and Environmental Systems Division, Argonne National Laboratory (Argonne, Illinois: 1978), p. 1.

Since the early 1970's there have been many studies to predict the socioeconomic impacts of energy developments at specific sites in the West. The temporary reliance on coal as a major energy source has lead to a rapid acceleration of coal-related development in the West, particularly in the sparsely populated Northern Great Plains region of Wyoming, Montana and North Dakota.

At the same time that the rate of energy development in the West began to increase, other changes were also taking place particularly in the nature of power plant construction. Because of the location of the coal reserves as well as more restrictive environmental laws and regulatory siting criteria, plants tended to be built in more remote locations. The 1970's also saw the introduction of a new larger breed of facility, a greater propensity for multiple units and a rise in the ratio of engineering and draft labor hours to kilowatt size due to new safety regulations, new environmental features, supervisory problems and plant complexities.[2]

Utilities as well as communities experienced adverse effects from such projects. Reoccurring shortages of specialized craftsmen, high turnover and absenteeism among the work force, schedule delays, low productivity and higher than expected workforce peaks resulted in skyrocketing costs for the utilities and their customers. Approximately $50 million of $100 million cost overrun at the first three Jim Bridger units (1,500 megawatts) in Rock Springs, Wyoming has been attributed to high worker turnover. Almost 70,000 workers were employed during construction, at one time or another.[3]

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[2]William C. Metz, "The Mitigation of Socioeconomic Impacts by Electrical Utilities," Public Utilities Fortnightly, September 11, 1980, p. 34.

[3]Ibid.

What follows is an attempt to summarize some of the findings of various studies aimed at identifying the major adverse socioeconomic impacts of energy-related projects on local communities and efforts currently under way to mitigate their effects.

As has already been noted, the consequences associated with socioeconomic impacts caused by "boomtowns" not only affect the local community, but also are transmitted to energy producers in the forms of higher costs from declines in productivity due to labor turnover and to consumers in the form of higher prices.

John S. Gilmore, who has written extensively on the problems of "boomtowns," theorizes that intensive energy development in western rural areas generates a "self perpetuating problem triangle" that degrades the quality of life because often the community's tolerence for population growth is exceeded. His theory is based on the premise that siting large energy developments in rural areas often stimulates population growth rates that exceed local capacities to generate public revenue and provide additionally needed services. When this growth rate is exceeded, labor force turnover rates increase and the area becomes progressively less attractive because reduced industrial productivity further incapacitates the generation of public revenues and the quality of life deteriorates.[4]

For example, in an extensive survey in September, 1974, newcomers to the Rock Springs-Green River, Wyoming boomtown rated local wages, job satisfaction and career opportunities very high. Nevertheless, 60 percent of the newcomer households indicated they planned to leave the community

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[4]John S. Gilmore, "Boomtowns May Hinder Energy Resource Development," Science, February 13, 1976, p. 536.

within one year unless health services improved. Housing, sanitation, road and street maintenance, schools and shopping facilities were also cited as reasons for leaving the community.[5]

As a result of these and other related problems, major efforts at forecasting impacts and identifying and analyzing alternative mitigation strategies of energy development is occurring under the sponsorship of the Department of Energy at the Argonne National Laboratory in Argonne, Illinois.

In a study to examine the sensitivities of socioeconomic impacts on alternative economic, demographic and geographic characteristics of a site, researchers compared the effects of the development of various coal mining and related coal conversion technologies on nine counties from four coal regions in the United States.[6] The study found that the rate and magnitude of socioeconomic changes at a specific site directly depends on the following factors:

1. the capital and manpower requirements of the proposed facility
2. the availability of local workers at the site
3. the size of the labor pool within commuting distance
4. the accessibility of public and private services.

The analysis showed greater population impacts and less local employment for the Montana counties studied (Yellowstone, Rosebud and Custer) than their counterparts in the Interior and Appalachian regions. It also predicted considerable variation in the impacts associated with

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[5]Ibid., p. 439.

[6]Erik J. Stenejhem, et al., An Empirical Investigation of the Factors Affecting Socioeconomic Impacts from Energy Development, (Argonne National Laboratory, Argonne, Illinois: September 1977).

the siting of an 800 MW power plant and associated mine in the different Montana counties.

The impacts of the construction and operation of such a facility varied from an expected peak population change of 1.6 percent in Yellowstone County and an increase in local jobs of 2,800, to a peak population increase of 78 percent and an increase of 340 local jobs in Rosebud County.

These differences are due primarily to the variations in the employment multipliers and the availability of local workers. Yellowstone County with its expected annual addition of 640 workers to the total labor force and an estimated multiplier of 3 is in stark contrast to Rosebud County with an annual increase to its available labor supply of 80 and an estimated employment multiplier of 2.2.[7]

Generally, the greater the population and labor force available in a city, the greater its capacity to accommodate major coal related development without adverse impacts.

The study used four measures to determine high, medium and low sensitivity to adverse local impacts. They are:

1. the absolute population of the county at the time of impact
2. the density of the population
3. the proximity in miles to the nearest regional trade center
4. the existing relationship between basic and secondary employment (the multiplier).

As a result of their long involvement in predicting and assessing the social, economic and institutional changes that accompany energy developments, researchers in the Energy and Environmental Systems Division at

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[7]Ibid., p. 34.

the Argonne National Laboratory have developed a model that will be able to analyze the socioeconomic impacts accompanying energy development for any county in the United States. Known as SEAM (Social and Economic Assessment Model) it is in reality a series of submodels and data bases that have recently been integrated and computerized.[8] The model can be used to predict population changes, employment, housing needs, public service requirements, secondary impacts, and the cost of providing public services.

Similar research is being conducted at the University of Oklahoma under the sponsorship of the Office of Research and Development of the U. S. Environmental Protection Agency. These studies are part of a three-year assessment focusing on six energy resources in eight western states. The results of these studies are being published under the series title Energy from the West.

Researchers have identified three general factors that affect social and economic impacts as well as six locational factors that also affect these impacts. The three general factors are labor intensity, capital intensity and scheduling.[9]

Local requirements for housing, schools and other services are determined by the intensity of the labor needed for the project. Large differences between construction and operating labor requirements only exacerbate population related impacts. Facilities tend to be either inadequate during construction or overbuilt for the operation phase.

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[8]Stenejhem, Summary Description of SEAM.

[9]Irvin L. White, Energy from the West, Vol. I: Introduction and Summary; (Norman: University of Oklahoma Press, 1979 for the U. S. Environmental Protection Agency), p. 94.

The simultaneous scheduling of labor intensive technologies in an area will only serve to exaggerate the impacts by concentrating the number of construction phase workers and exaggerating the difference between construction and operating labor requirements. Prolonging and/or staggering construction schedules can minimize adverse impacts.

All conversion plants are more capital intensive than mines and can produce public revenues in excess of added public expenditure over the long run. However, property taxes are generally not available during construction when the demands on local government are usually the greatest. In addition, most increases in revenue from energy projects usually go to the county government, but it is the towns which have to absorb population and meet facility and service needs. Local merchants and local residents gain the most economically during construction. The majority of construction workers tend to come from outside the local area, which often reduces the benefits local residents anticipate. During operations, workers tend to be local residents and new opportunities may open for local service industries.

The six locational factors which affect the impacts are community size and location, the capability of existing institutions, historical patterns of outmigration, characteristics of the local labor force, local financial conditions and the culture and lifestyle of the area.

The most important existing condition is the size of the community before energy development. Rural areas and small communities experience more dramatic impacts and require longer lead times to provide adequate services and facilities. The isolated community is more likely to experience severe impacts than any one community in an area where there are numerous towns. Detrimental population impacts will be less in communities where the local labor force can meet some of the labor needs of the project.

Communities less than 5,000 almost always have inadequate services and planning capabilities. Communities of 10,000 or more (especially larger than 25,000) are better equipped to handle the impacts since they usually have a developed community service system and planning professionals to deal with changes.

Construction workers demand a full range of social, professional and cultural services which smaller communities may not be used to providing. A large influx of newcomers may cause changes in leadership and a shift in the dominant values and attitudes in small communities.

Cities with historical patterns of outmigration may have excess capacity in schools and facilities and thus be better able to absorb the impacts of construction.

The size and composition of the local labor force will influence the impact. Preconstruction training programs for underemployed and unemployed workers can lower the number of nonlocal workers required and result in more benefits to the community. However, the study revealed that this is often easier for the operation than the construction phase. Of all construction occupations those most likely to be filled by local residents are laborers, cement finishers and carpenters and even those occupations tend to involve 40-50 percent nonlocal workers. The proportion is up to 80 percent for some skills.

Without training programs for local workers, the largest category of new employment for local residents tends to be in relatively low paying service jobs. Typically professional and more specialized service jobs go to outsiders.

While many communities do not have adequate revenues to respond to energy development in a timely manner, this is not necessarily the case in Montana. A portion of mineral leasing and severance tax money are earmarked as payments to impacted communities. However, the determining factor is the timeliness of the state response. A surplus of state funds is meaningless unless it reaches the local level.

This study also found the general "quality of life" to be an important influence on the consequences of energy development. "Quality of life" is a subjective attribute composed of a variety of factors with differing priorities for different people. These usually include medical care, professional services, adequate housing, schools and recreational and cultural opportunities. Whatever its definition, it is important, not only to the longtime residents of these communities, but to the newcomers as well, even if their residency is only temporary.

Utilities, as well as towns and states in the West, have now begun to devise strategies for dealing with the social and economic impacts brought about by energy development.[10] These vary greatly from attracting and maintaining a stable quality work force to facilitating project siting by relieving community anxiety. The effort varies according to the labor availability in the area, the accessibility of the site, state and community laws, attitudes of the local community and the utility's own philosophy.

They may include financing or providing housing, providing transportation to and from the construction site, donating land for schools

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[10] William C. Metz, "The Mitigation of the Socioeconomic Impacts of Electric Utilities," p. 35.

and community facilities, tax prepayments for credit against future property taxes, underwriting vocational programs, or grants to communities to study and prepare for impacts.

The Montana Power Company is currently spending millions on the town of Colstrip to maintain an adequate "quality of life" for the people of Colstrip during the construction phase of its Colstrip units 3 and 4. Each new power plant represents a financial investment in the billion dollar range. Costs of project delay resulting from work-force problems is up to several thousand dollars per day and rising. The majority of utilities now consider mitigation good business practice and an investment in minimizing delay and overall cost.

IV. THE ECONOMY OF GREAT FALLS

An Economic History of Great Falls

The city of Great Falls is situated on the site of the "great falls" of the Missouri River first noted by Lewis and Clark in their journals in June, 1805. The early economic development of Great Falls has been attributed to three factors: the availability of hydroelectric power, the agricultural potential of North Central Montana, and the promotional efforts of Paris Gibson.[1] An early developer of the city of Minneapolis, Paris Gibson first visited the area in 1882 and was instrumental in attracting the Great Northern Railroad, which completed its line to the area in 1887. Great Falls incorporated in 1888 and elected Paris Gibson its first mayor.

By 1890 Great Falls had a population of almost 4,000. Black Eagle Dam was built to provide the hydroelectric power required for the ore smelting operations of the Boston and Montana Consolidated Copper and Silver Mining Company which began construction of a copper reduction plant nearby. Meat packing and flour milling had also come to Great Falls.

The copper reduction plant was purchased in 1910 by the Anaconda Copper Mining Company and was replaced by new electric copper and zinc refineries in 1916. A copper wire and cable mill and a ferro-manganese

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[1] THK Associates, Economic Base Study 1974: City of Great Falls and Cascade County, Montana, (prepared for the Great Falls City County Planning Board, 1974), p. 1.

plant were also added at that time. The Montana Flour Mills (now Conagra) and General Mills, Inc., milling and storage facilities, were also constructed during this period.

Black Eagle Dam was rebuilt in 1928 and eventually four other hydroelectric dams were constructed on the Missouri River, providing a total of 220,000 kilowatts of net plant capacity power.

During World War II Malmstrom Air Force Base was established as a B-17 training facility. Based largely on its location with respect to the Polar Circle and its excellent flying weather, Malmstrom AFB became a Strategic Air Command and Air Command Defense Center in 1954. In 1958 the 341st Strategic Missile Wing assumed responsibility at the base for the Minuteman Intercontinental Ballistic Missile Program. The base presently supports approximately 200 Minuteman Missiles.

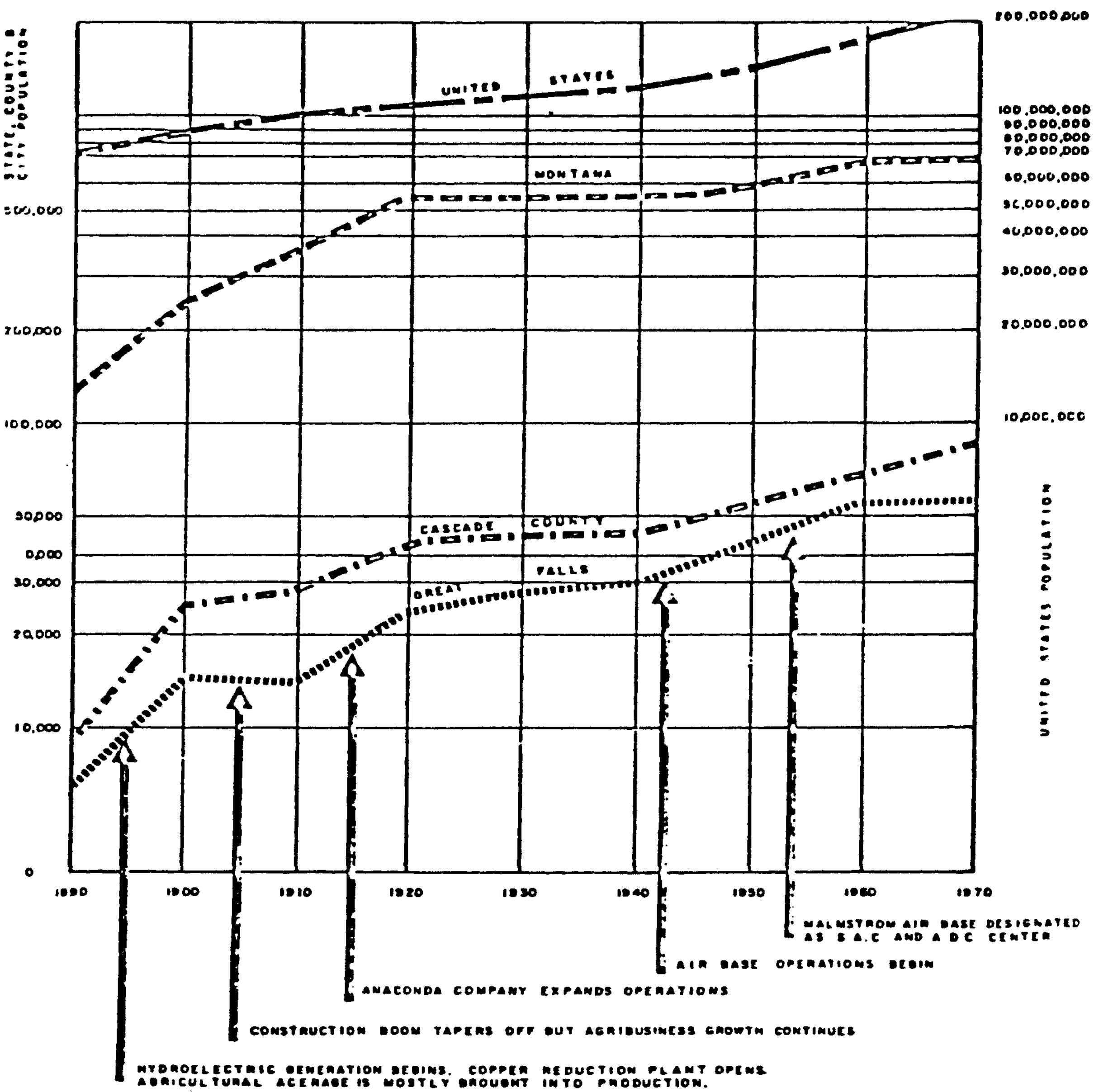
Growth in employment within the basic industries of hydroelectric power production, smelting, railroads, agriculture, meatpacking, flour milling and defense led to increases in population. Boosted primarily by high military expenditures, Great Falls employment grew at its most rapid rate through the early 1960's. The military construction program peaked in 1967.

Figure 1, taken from a 1974 study of the Great Falls economy, depicts population growth in Great Falls, Cascade County, the state of Montana and the United States from 1890 through 1970.

In recent years, the city's economic expectations have suffered a number of serious setbacks. In 1973 the Anaconda Company closed its zinc plant (800 employees) and its aluminum wire plant (60 employees). Since the merger of the Great Northern Railway, the Northern Pacific Rainway and the Chicago, Burlington and Quincy Railroad, Great Falls is

FIGURE 1

COMPARATIVE POPULATION TRENDS



SOURCE; THK Associates, Economic Base Study 1974; City of Great Falls and Cascade County, Montana, no longer on the main line for rail traffic between the South or the Midwest and the West Coast. As a result, the Burlington Northern transferred 200 railroad workers out of the city. In 1975 the Great Falls Meatpacking Plant closed idling 100 employees.

Peak military staffing at MAFB occurred during 1973-74 partly masking the effect of the Anaconda closure on the local economy.[2] Since then there have been declines associated with general cutbacks and lower staffing levels. Many of these declines were again masked when beginning in 1977 the L. D. Smith Company and the Boeing Company moved workers into the area in order to renovate the Minuteman Missiles. These workers left in 1979.

In that same year the Department of Defense began a realignment program at Malmstrom AFB that will result in the loss of approximately 950 military and civilian jobs between 1979 and 1982. This will also result in the direct loss of $11.1 million from the local economy.[3] Other impacts of the realignment include an additional decrease in population, a decrease in the size of the labor force, an increase in the unemployment rate and a decrease in personal income for the community.[4]

The most recent economic blow to the city occurred on September 9, 1980, when the Anaconda Company announced the closure of its smelting and

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[2] Paul E. Polzin, "Missoula, Great Falls, Helena and Billings: A Review of the Seventies and What's in Store for the 80's," Montana Business Quarterly, Spring 1980, p. 27.

[3] SRI International, Economic Adjustment Program: Great Falls/ Cascade County, Montana, (prepared for the President's Economic Adjustment Committee, Office of Economic Adjustment, Office of the Assistant Secretary of Defense, the Pentagon, Washington, D.C., March 1980), p. 37.

[4] Ibid., p. 39.

refining operations in Montana. The closure of the Anaconda refinery in Great Falls will mean the loss of an additional 500 jobs with an annual payroll of more than $15 million. While it is still too early to ascertain the final indirect effects on employment, population and personal income in Cascade County, these losses will surely compound the economic problems associated with the realignment at Malmstrom. However, with severance and unemployment benefits, the effects may be delayed for a year or more. The possibility also exists that other uses may be found for the refinery and that some of the workers may be reemployed.

A study done by SRI Associates for the Office of Economic Adjustment to assess the impact of the Malmstrom realignment and to aid in the establishment of a readjustment program concluded: "Problems with the Great Falls economy are primarily structural. An extensive and diverse industrial base is lacking and the city depends on Malmstrom Air Force Base."[5]

Regional economists have long held that diversification is essential for the growth and expansion of metropolitan regions. One-industry towns tend to have economic trends that coincide with economic trends in their particular base industry. This tends to aggravate instability and intensify the community's sensitiveness to the fortunes suffered by individual firms and their products.[6] Certainly the calamity experienced by the town of Anaconda as a result of the closure of the Anaconda smelter there is a prime example.

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[5]Ibid., p. 32.

[6]Joseph Haring, ed. Urban and Regional Economics, "Metropolitan Growth and Regional Policy," by James J. Green (Boston, Houghton Mifflin, Co., 1972), p. 271.

In recognition of the need to diversify the economic base and in response to the Malmstrom realignment, the Economic Growth Council was formed in June, 1979. It is presently an incorporated organization composed of the representatives of local businesses, civic groups and governmental bodies. Through its various programs, it is the intent of the Growth Council and its staff to assist the community in diversifying and increasing its economic base in order to offset the expected declines associated with the cutbacks at Malmstrom and the closure of the Anaconda smelter.

An Economic Profile of Great Falls

Analyzing the current state of the Great Falls economy is difficult because of the lack of available statistics. The latest year for which complete data are now available is 1978, although some limited information from the 1980 Census has been released. Probably the most meaningful analysis of the local economy has been done by Paul Polzin at the Bureau of Business and Economic Research at the University of Montana. The following analysis is taken from "Montana's Economic Outlook Seminar" presented by the Bureau of Business and Economic Research in Great Falls in February 1980 and published in the Spring 1980 issue of the Montana Business Quarterly.[7]

The analysis concentrates on charting the general trends in a local economy over time, identifying the determinants of those trends, and analyzing certain segments of the economy to forecast whether those trends are likely to continue.

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[7] Paul E. Polzin, "Missoula, Great Falls, Helena and Billings: A Review of the 70's and What's in Store for the 80's," Montana Business Quarterly, Spring 1980, pp. 18-34.

Population

Population estimates for the period 1970-78 had shown the population of Cascade County increasing modestly during the 1970's, but at a slower rate than the state's other largest counties.[8]

However, totals recently released from the U. S. Bureau of the Census reveal that both the city and the county have actually experienced slight declines in population. The population totals for 1970 and 1980 for both the city and county are shown in Table 1.

Table 1

Population

Place	Year		Change	
	1970	1980	Number	Percent
Great Falls	60,091	56,568	-3523	-5.8
Cascade County	81,804	80,639	-1165	-1.4

SOURCE: U.S., Bureau of the Census.

While both the city and county have declined, the data also indicate that the city is losing population to the county. Table 2 indicates the working age population of Great Falls.

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[8] Ibid., p. 19.

Table 2

Working Age Population by Age and Sex

Sex	Age	Population	Percent
Males	18-24	2,975	4.95
Females	18-24	3,801	6.47
TOTAL		6,866	
Males	24-44	7,110	11.83
Females	24-44	7,317	12.17
TOTAL		14,427	
Males	45-54	3,230	5.37
Females	45-54	3,306	5.5
TOTAL		6,536	

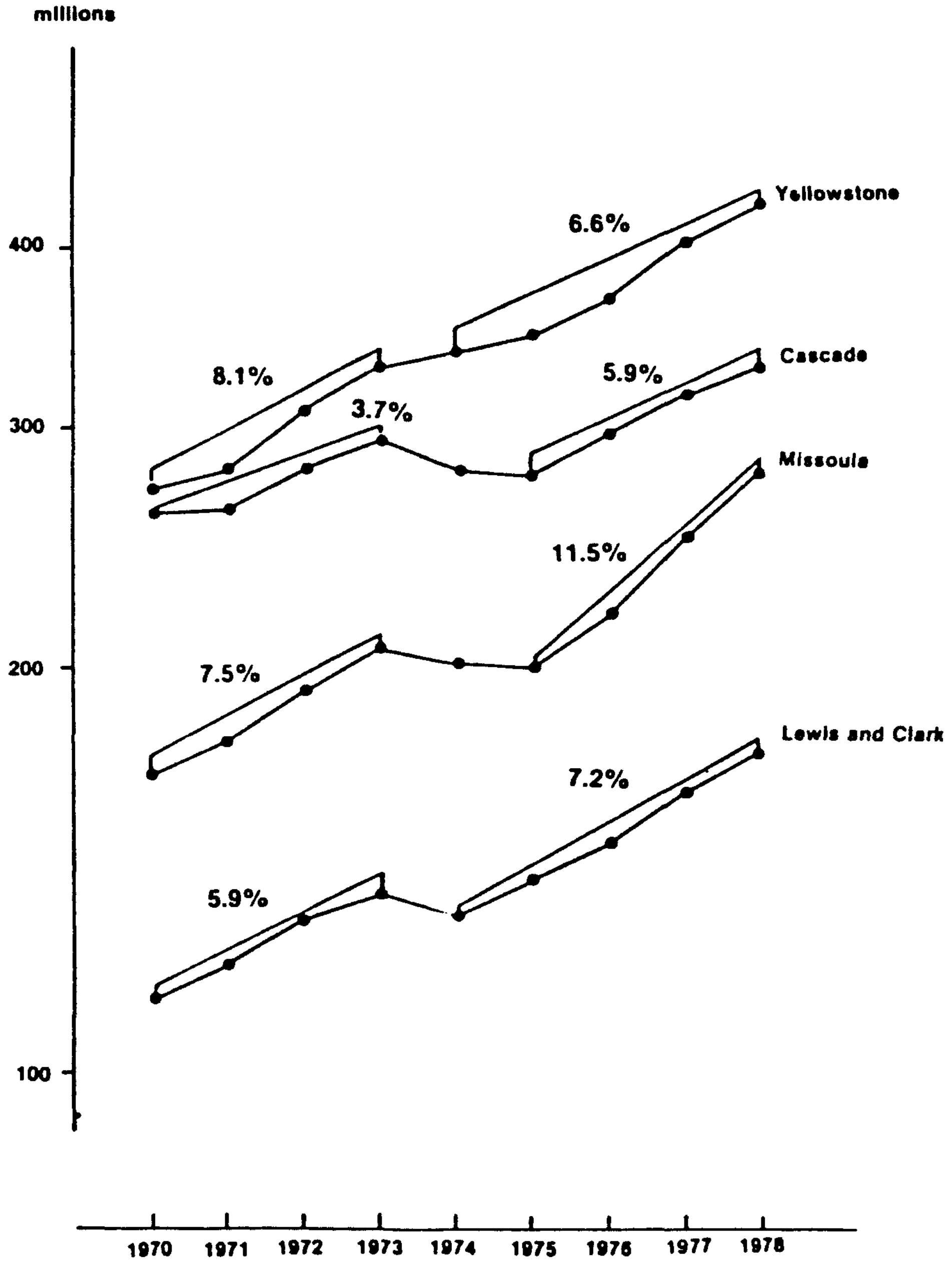
SOURCE: Great Falls City-County Planning Department.

Non Farm Earnings

Non farm earnings, or the earnings of all persons (except those in agriculture) working in the current production of goods and services are used as one gauge of economic activity. Figure 2 reveals that despite a severe decline during the 1974-75 recession, the Great Falls economy experienced overall growth. However, Cascade County experienced the slowest growth rate of the four major counties throughout the period.

FIGURE 2

Nonfarm Earnings in Yellowstone, Cascade, Missoula and Lewis and Clark Counties



SOURCE: Paul Polzin, "Missoula, Billings, Great Falls and Helena: A Review of the 70's and What's in Store for the 80's," Montana Business Quarterly, Spring 1980, p. 20.

Per Capita Income

Figure 3 reveals that despite the city's economic problems, per capita income rose at an average rate of 2.4 percent per year between 1970 and 1978. However, the county once again experienced the lowest overall growth rate. The reader should keep in mind that 1980 census data reveal that the Bureau of the Census probably overestimated the population growth between 1970 and 1978. It is, therefore, probable that once all of the data are readjusted, the per capita income for Cascade County is likely to be slightly higher than indicated in Figure 3.

Basic Industries

Export industries have previously been identified as the primary source of growth for Cascade County. Agriculture, transportation, food processing, manufacturing, the federal government, and the export portions of wholesale and retail trade have generally been identified as basic industries in Cascade County.

Earnings in some basic industries in Cascade County between 1970-78 are indicated in Figure 4. They do not include health care earnings or contract construction which are difficult to measure. Nevertheless, the slow growth in Great Falls can be traced to its lack of export industries. The largest single component in the city's economic base is Malmstrom AFB. A large percentage of the federal civilian employees in the county are employed by the Department of Defense, so that MAFB directly or indirectly accounted for over one-half of the local economic base.

The loss of employment due to the shutdown of the Anaconda zinc refinery and the transfer of the Burlington Northern workers can be seen in the decline in primary metals manufacturing and transportation. Growth

FIGURE 3

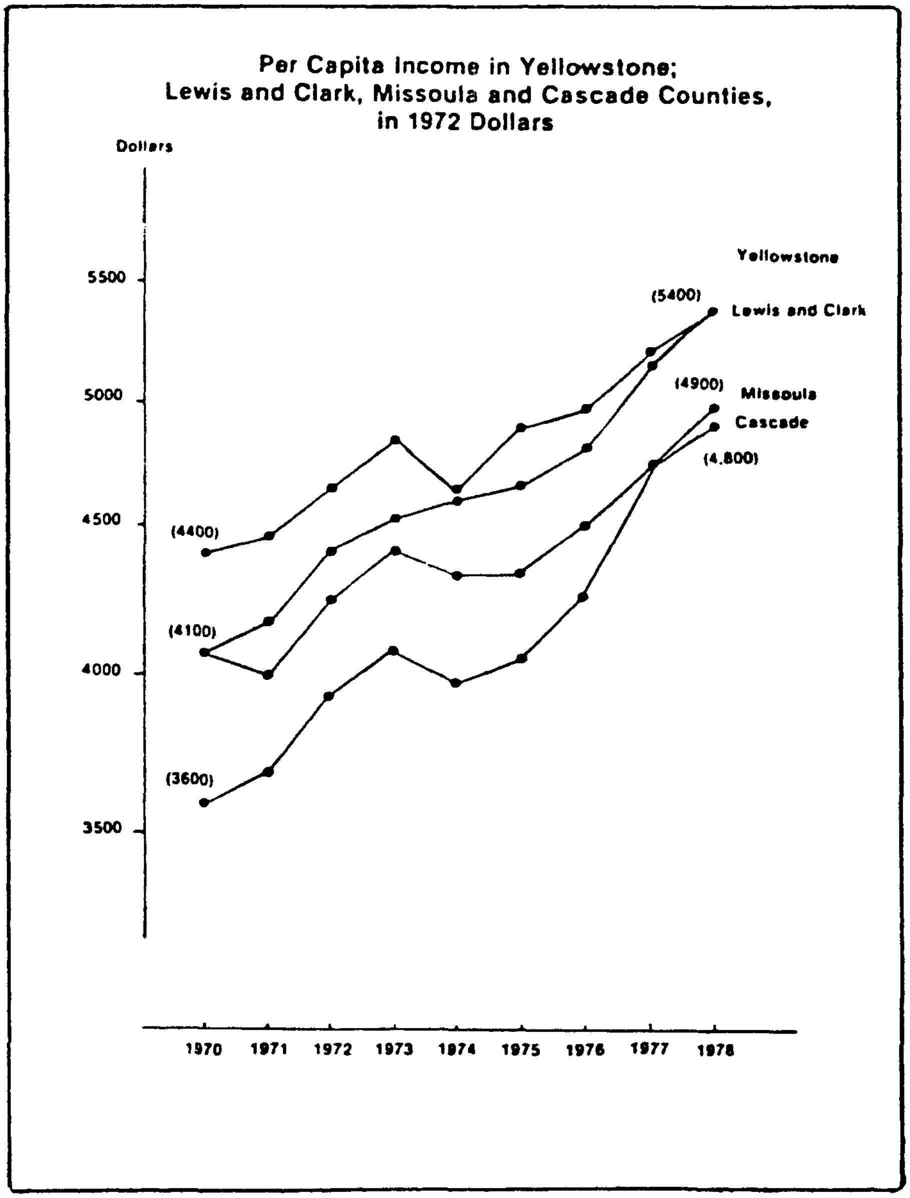
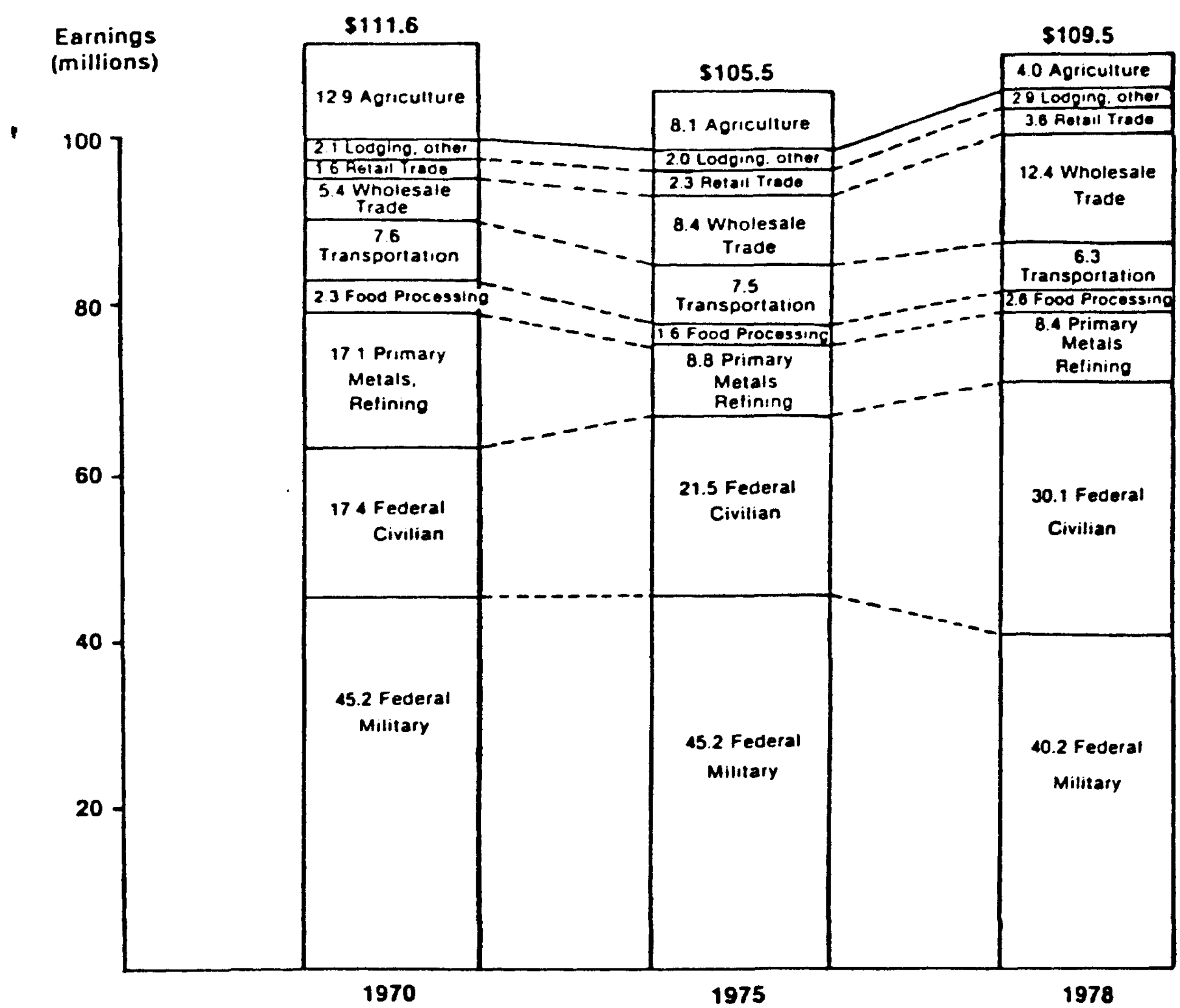

Per Capita Income in Yellowstone;
Lewis and Clark, Missoula and Cascade Counties,
in 1972 Dollars
Dollars
5500
5000
4500
4000
3500
(4400)
(4100)
(3600)
(5400)
(4900)
(4,800)
Yellowstone
Lewis and Clark
Missoula
Cascade
1970
1971
1972
1973
1974
1975
1976
1977
1978

FIGURE 4

Earnings in Basic Industries, Cascade County

1972 dollars



has occurred in food processing and wholesale and retail trade.

Many changes have occurred since 1978, however, which will result in major alterations in the graph. The realignment at Malmstrom will reduce military related earnings and the closure of the Anaconda refinery will further reduce earnings from the primary metals manufacturing sector. Each of them represents important components of the economic base.

Also, other industries may be contributing to the community's economic base. Great Falls may grow as a regional headquarters. The Farmer's Union and Blue Cross have both announced plans to build new regional headquarters in Great Falls. The Great Falls Livestock Cooperative seeking equity to build a new meat packing facility near Great Falls and a site near Great Falls has been selected by the Montana Power Company as the primary location for a 350 Megawatt coal-fired generating plant, Resource 89.

Schools

Enrollment in the Great Falls Public Schools from the Fall of 1970 to 1980 is shown in Table 3.

According to the SRI report, the loss in students over the years is consistent with national trends and due to the declining birthrate. In fact, the two percent average annual loss for Great Falls between 1970 and 1976 was less than the national loss of 3 percent during the same period.[9]

As a result of declining enrollments, five elementary schools were closed in the Fall of 1979. Their closure brought the remaining

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[9]SRI International, Economic Adjustment Program: Great Falls/ Cascade County, Montana, p. 37.

Table 3

Total Enrollment in Great Falls

Primary and Secondary Schools
1970-1980

Year	Enrollment Total	Change	
		Number	Percent
1970	19,284	--	--
1971	19,034	-250	-1.3
1972	18,484	-550	-2.9
1973	18,309	-145	-1.0
1974	17,612	-697	-3.8
1975	16,817	-795	-4.5
1976	16,579	-238	-1.4
1977	16,144	-435	-2.6
1978	14,854	-1,290	-8.0
1979	13,876	-978	-6.6
1980	13,214	-662	-4.8

SOURCE: Harold Wenaas, Superintendent of Schools.

elementary schools near capacity. A breakdown in the enrollment data for the Great Falls public schools as of the Fall of 1980 is shown in Table 4.

Public school enrollment is projected to drop by at least 723 students next year. This does not allow for enrollment drops that may be associated with the closure of the Anaconda refinery or the cutbacks at Malmstrom AFB.

Most of the enrollment declines of the 1970's were due to the declining birthrate. That general decline is now leveling off in the elementary schools. Two-thirds of the projected drop in enrollment in 1981 is expected to be at the secondary level.

Table 4

Current Enrollment Great Falls Public Schools

Fall 1980

	Number of Schools	Enrollment	Teacher/Pupil Ratio
Elementary	16	6,540	19.18
Junior High	4	2,993	15.1
Senior High	2	3,382	16.5
Special Education		299	N/A
		13,214	

SOURCE: Harold Wenaas, Superintendent of Schools.

Table 5

Projected Enrollment Great Falls Public Schools

Year	Number of Students	
	Without Anaconda and Malmstrom Cutbacks	With Allocation For Anaconda and Malmstrom
1981	12,491	12,340
1982	11,927	11,425
1983	11,507	10,936
1984	11,232	10,501
1985	10,958	10,057

SOURCE: Harold Wenaas, Superintendent, School District Number 1.

Housing

Along with the preliminary population figures for each community, the U.S., Bureau of the Census also released housing totals and vacancy rates, so that an accurate assessment of the availability of housing in

Great Falls and the surrounding communities is now possible. The housing supply and vacancy rates for Great Falls and the surrounding communities are shown in Table 6.

Table 6

Housing Units and Vacancy Rates for Great Falls and the Surrounding Communities

Community	Number of Housing Units	Vacancy Rates
City of Great Falls	23,812	8.9%
Great Falls Urban Area	28,246	8.3%
Belt	339	0.3%
Eden-Stockett Area	326	2.0%
Manchester West to Vaughn	390	4.6%
Sun River Valley	210	1.0%
Cascade	349	2.6%

SOURCE: Great Falls City-County Planning Department

While the city and the four and one-half mile area surrounding it have high vacancy rates, not much excess capacity appears to exist in the surrounding communities. At the rates indicated by the preliminary census data, the Great Falls urban area currently has 2,344 vacant housing units.

Through October 1980 only 76 permits for the construction of dwellings were issued, perhaps a reflection of the housing glut currently being experienced in the community.[10] Listings data from the month of October from 1971 to 1980 are shown in Table 7. The increase in activity

[10]City-County Planning Department.

Table 7

Multiple Listing Service Data for October 1971-1980

Year	Number Listed	Number Closed	Gross Sales	No. of DP's Submitted	Average Price	No. of Current Listings
1971	74	57	$1,094,622.00	51	$19,204	315
1972	96	64	1,373,650.00	48	21,463	389
1973	83	60	1,400,833.00	46	23,347	347
1974	81	63	1,501,846.00	39	23,838	326
1975	124	94	2,444,560.00	80	26,005	387
1976	162	100	3,589,304.00	104	35,893	449
1977	187	134	5,237,883.00	107	39,088	716
1978	278	134	5,996,503.54	156	44,184	1,178
1979	297	150	8,728,104.90	101	47,014	1,583
1980	250	119	6,207,321.84	78	49,710	1,218

During October 1980, members of the MLS listed 173 Residential Properties, 15 Mobile Homes, 22 Commercial, 14 Multi-Family Dwellings, and 26 Lots/Acreage.

beginning in the Fall of 1975 corresponds with the arrival of the missile workers. The departure of these workers in 1979 is again reflected in the decline in activity experienced in 1980.

On November 4, 1980 there were 1,218 properties for sale in Great Falls. They break down as follows:[11]

Residential	792
Mobile Homes	56
Commercial	72
Multi Family	121
Lots-Acreage	178

The MLS also publishes a Rental Bulletin. As of November 4, 1980, 569 rental units had been listed with the MLS. There is no information on the number actually rented. However, Mr. James Basts of the Multiple Listings Service indicated that the MLS rental listings were usually not duplicated in the local paper. A tally of the units listed in the Great Falls Tribune on December 7, 1980 indicated that there were at least 175 units listed for rent.

Informal monitoring of the number of properties for sale by owner do not indicate that they are a major consideration. Recently there have been between 20 and 25 properties for sale by owner. Housing is currently available in all price ranges in Great Falls beginning around $20,000 and going to $345,000. The mean price is $49,710 with the majority of listings occurring in the $40,000 to $60,000 price range.

The census data that have been released to date indicate nothing about the quality of the vacant units. However, with the available information it is impossible to duplicate the Census Bureau estimate of 2,344

[11] Great Falls Multiple Listing Service, November 6, 1980.

units, indicating that some of the vacant units may have been taken off the market. Nevertheless, there is currently an abundance of housing available in the Great Falls area.

V. RESOURCE 89

In April of 1979 the Montana Power Company revealed the need for new base load generating facilities by 1989 if demand continues at the rate the utility has projected. MPC's base load is currently growing at an annual rate of 5.5 percent.[1] Assuming the continuation of this growth rate, MPC began planning a new wholly owned 350 megawatt (MW) coal-fired generating unit to be known as Resource 89.

Amendments to the state's Major Facility Siting Act adopted in April, 1978, require utilities to study alternative sites for each proposed major facility. MPC considered four possible sites for Resource 89. One was located west of Hardin, one was near Devon, between Chester and Shelby and the final two are located near Great Falls, the selected one lying east near Salem, and the other north near Portage.

Baseline environmental data were gathered for all four sites. In addition, coal availability, overall site and plant economics, as well as the socioeconomic characteristics of the various sites were evaluated to assist the final site selection.

While preliminary planning was based on a 350 MW unit, a size optimization study is being performed as part of the preliminary engineering to determine the most economically sized unit to fit MPC's load growth.

Present planning has allowed for a consumptive water usage of 5,700 acre feet/year based on a 350 MW sized plant using evaporative

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[1] Great Falls Tribune, April 5, 1979, p. 1.

cooling towers and wet scrubbers such as those used at Colstrip. A "closed loop" water system is being developed so that wastewater will be discharged other than by evaporation. The actual area encompassed by plant facilities, including storage ponds, coal piles and mechanical facilities, probably will not exceed 600 acres.

The selection of equipment to control plant emissions is ultimately dependent on the particular coal to be used. Preliminary engineering is now in progress to select the appropriate control system for the alternate coal sources. By law, the plant will comply with state and federal air and water quality standards.

An actual cost estimate based on final site conditions and on actual equipment to be used in the proposed plant has not yet been performed. However, projections based on Colstrip Unit #1 show that a 350 MW unit to be on line in 1989 would cost on the order of $525 million in 1989 dollars.[2]

With preliminary engineering and the gathering of baseline data now in progress, MPC plans to announce a final site in early 1981. Permit applications are projected to be submitted in the second quarter of 1981. It is estimated that construction would begin in 1985 and the unit would be on line in July 1989.

Typically a 350 MW plant takes four years to build. During peak construction, which would occur during the summer of 1987, about 1,000 construction workers would be employed.[3] Figure 5 shows the proposed

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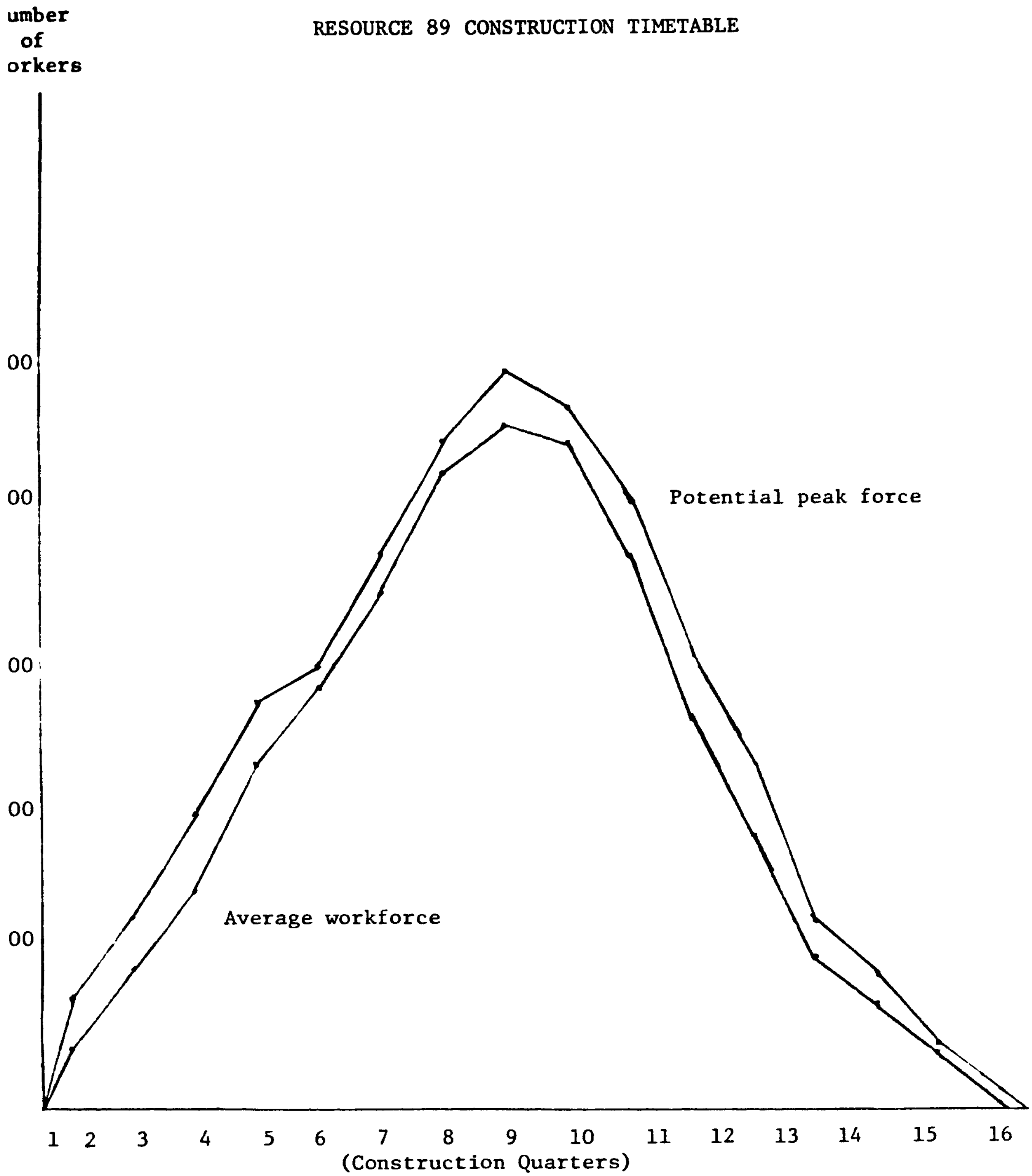
[2]Montana Power Company, Resource 89: Fact Sheet.

[3]Montana Power Company, Preliminary Manhour Levels by Quarters: Resource 89, (September 5, 1980).

FIGURE 5

RESOURCE 89 CONSTRUCTION TIMETABLE



construction timetable. When completed and in commercial operation, the plant will employ approximately 160 people.[4]

Magneto Hydro Dynamics

Magneto hydro dynamics is an advanced technology for generating electricity from coal by using superheated gas in place of a conventional metal conductor. The MHD development program now being conducted by the U. S. Department of Energy is one potential solution to the use of oil and gas for electric power generation.

MHD generators have several advantages over more conventional coal-fired steam generating plants. Open cycle MHD conversion systems that are integrated as topping cycles with conventional steam generating plants can extend the usefulness of coal reserves and minimize environmental impact. The average coal-fired plant is able to make use of only 35 to 40 percent of the fuel concumed to generate electricity. With an MHD cycle, efficiency can be raised to nearly 60 percent. This means that more electrical power can be produced from each ton of coal. While a conventional plant might produce 3,000 kw hours from one ton of coal, an MHD plant could produce 4,500 kw hours from the same ton of coal.

MHD generators require much less water than conventional power plants, making them attractive for coal-rich but arid western regions. The MHD process also requires all exhaust gases to be treated before going up the stack, making MHD plants substantially cleaner than conventional generation.

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[4]Montana Power Company, Resource 89: Operating Manpower, (October 1, 1980).

While the potential advantages of MHD are considerable there are many technical problems associated with using coal as a source of fuel. Commercial scale systems are estimated to still be 20 years away.

As of October, 1979, the Department of Energy estimated that the government has spent about $273 million to develop MHD. It will cost an additional $2 billion through the 1980's to continue to develop and demonstrate this technology.[5]

The DOE presently has a two-phased program that calls for testing at three new facilities and a $372 million pilot plant. The third phase, a $1 billion commercial demonstration facility, has been dropped.

The "key" facility for the program is the Component Development and Integration Facility (CDIF) in Butte, Montana. Designed to test the durability and efficiency of specific components, this facility will provide most of the information for the design of the pilot plant. Two smaller test facilities are located in Tennessee.

The pilot plant or Engineering Test Facility will test a complete MHD/steam power system capable of producing ten times the MHD electrical power of the CDIF for 1,000-2,000 hours. The schedule for MHD development calls for the DOE to decide whether to proceed with pilot plant development 1½ years before commiting funds to design it. Fiscal year 1983 is the target date for issuing proposals and 1984 is the first year funds will be committed for design.

However, delays at the test facilities may cause changes in the proposed program. All three facilities experienced delays in beginning

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[5]General Accounting Office. "Magneto Hydro Dynamics: A Promising Technology for Efficiently Generating Electricity from Coal," Report to the U. S. Congress by the Controller General, February 1980, p. i.

testing. Testing at the CDIF was delayed one year. October, 1980 is now the date testing will begin. In order to meet their timetable the DOE must decide in 1981 whether or not to proceed with the design of a pilot plant. Delays at the CDIF mean that in order for the DOE to meet its timetable, it would have to make a decision on the pilot plant before receiving adequate test data from the CDIF. At the present time the DOE is considering several options for accelerating MHD development. These include using overtime to speed up the process at the CDIF, beginning preliminary design of the pilot plant earlier, or skipping the pilot plant altogether and designing and constructing a MHD demonstration plant based on existing data. However, the technical risks are great with any speed-up in the schedule.

A General Accounting Office report recommended that the DOE should not design a pilot plant until after completing tests at the CDIF but should evaluate alternative approaches to the plant.

Originally the energy department planned for the plant to stand alone and be wholly owned and operated by the government. Recently suggestions have come forth for building a plant in cooperation with utilities or industry. The DOE has shown more interest in this approach since it would involve potential users with the design and operation of the plant and would help gain support for the method. Utilities (which would be the largest ultimate users of the method) have indicated more interest in results if it is a joint project.[6]

At least two utilities, the Montana Power Company and California Edison are about to propose that one of their facilities be modified to

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[6]Ibid., p. 32.

accommodate MHD. The Montana legislature has already appropriated $500,000 to evaluate the issues related to citing an MHD plant in the state. More recently, the Montana Power Company announced plans to propose that the pilot plant be built in conjunction with their Resource 89, coal-fired plant.

It appears then that the DOE's plan for MHD development may undergo revision as the department begins to consider the alternatives for its MHD development program. Certainly it is possible that some kind of MHD facility could be a part of Resource 89 or adjacent to it. However, since no decisions or even firm proposals have yet been revealed, it is impossible to speculate as to the economic impact of the addition of MHD. Several factors would influence that impact. They include the ultimate size of the project, the timing of the construction in relation to Resource 89, and the degree to which both projects would use joint facilities and personnel. However, in the following analysis one scenario has been worked out to include a major project such as MHD.

VI. CONSTRUCTION PHASE

Population

Past research has shown that in communities experiencing energy development, new construction workers on the project represent the majority of new residents and are the principal determinants of the socioeconomic impacts.[1] The population increase depends on the extent to which nonlocal workers are employed on the project, the number of those who choose to live in the community in question, the number who bring their families with them, and the average size of those families.

Extensive surveying of over 3,000 construction workers on fourteen different projects in nine western states in 1975 for the Old West Regional Commission resulted in the development of several models which can be used to help predict some of the population impacts of energy development. The following analysis uses these models in an attempt to forecast some of the population impacts associated with the construction of Resource 89 in the Great Falls area. The researchers, in their final report, have been careful to point out that models do not imply that the composition of the workforce can be predicted in a mechanical way, but that the specifics of each site should be carefully considered and the results adjusted in accordance with the researcher's own knowledge of local conditions.[2]

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[1]Mountain West Research, Inc., Construction Worker Profile: Final Report, p. 30.

[2]Ibid., p. 89.

The mean ratio of nonlocal workers to the total workforce for the fourteen projects studied was .601.[3] Using multiple regression analysis a number of hypothesis were tested to explain some of the variations in the ratio from project to project. Several factors were found to influence the number of nonlocal workers on a project. They include the number of towns within daily commuting distance from the project, the population of each town, the distance of each from the project and the number of workers employed on competing projects in the area.

There are several communities within daily commuting distance of Great Falls. The communities included in this analysis are listed in Table 8. One hundred miles was judged to be the farthest daily commuting distance in the construction worker study. Given road and winter driving conditions in the Great Falls region, as well as the fact that most Montanans are not accustomed to commuting long distances to work, one hundred miles was judged too far. The farthest community considered for the analysis was Choteau at a distance of 72 miles. The distances are approximate and may vary by as much as ten miles between the two possible sites because of highway routes. However, given the nature of the regression equation, this variation will not significantly alter the results.

Most problematic at this time is identifying other projects in the area which may be competing for workers in the mid 1980's. Several smaller projects are now under consideration for the Great Falls area, including a meat packing plant, a dam on the Missouri River near Carter, an addition to Ryan Dam on the Missouri River near Great Falls and the

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[3]Ibid., p. 89.

Table 8

Communities Within Daily Commuting Distance of Resource 89

Community	Population	Distance
Cascade	774	33
Sun River Valley Division	605	27
Manchester Division	1,212	17
Eden-Stockett Division	866	17
Belt	819	23
Great Falls Urban Area	69,500	10
Fort Benton	1,697	40
Conrad	3,074	70
Augusta Division	847	67
Choteau	1,789	72

SOURCE: U.S., Bureau of the Census 1980 preliminary census totals.

Northern Tier Pipeline which would draw some workers from the Great Falls commuting area. Oil and gas exploration in the region has also been increasing. However, no final plans or timetables for any of these projects have been announced. Because the results of the regression equation are sensitive to the number of workers employed on other projects, three sets of calculations were computed using three different sets of assumptions about the number of workers employed on other projects. The first scenario assumes there will be little growth in economic activity in the area and no workers will be employed on competing projects. The second scenario supposes that some slow growth will occur and that other projects in the area will employ 150 workers. The third scenario assumes a much faster rate of growth or that some other major project such as MHD or another missile renovation employing 500 workers will be concurrent with Resource 89. The results of applying local data to the prediction model are shown in Table 9.

Table 9

Local Workers Predicted for Resource 89 Peak

Construction from Daily Commuting Region

Daily Commuting Region	Assumption I	Assumption II	Assumption III
Cascade	45	19	---
Sun River Valley	45	19	---
Manchester	47	21	---
Eden-Stockett	46	20	---
Belt	45	20	---
Great Falls Urban Area	231	206	145
Fort Benton	48	22	---
Conrad	51	25	---
Augusta	45	19	---
Choteau	48	22	---
Total local workers	651	393	145
Projected nonlocal	349	607	855

Intuitively, the results of the first scenario seem high. While it may be possible for the commuting region to supply a total of 651 workers for the project, it seems unlikely that all would have the requisite skills. Fully 44 percent of the total manhours on the project will be worked by electricians, pipefitters and boilermakers, skilled trades requiring prior training.[4] Previous research has shown that it is the least skilled jobs that tend to go to local workers.[5] Therefore, the first scenario appears possible only if training programs are instigated prior to construction.

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[4]Montana Power Company, "Preliminary Craft Labor as a Percentage of Total Manhours, Resource 89," (September 5, 1980).

[5]Energy from the West: Policy Analysis Report, p. 105.

The third scenario showing a much larger population impact would occur if some other very large project or a series of smaller ones were to be built concurrently with Resource 89. At the present time the only announced possibility is the MHD engineering test facility. However, that is by no means a certainty.

At this time it appears most likely that some slow economic growth will occur given the efforts of the local community to attract and develop export industries. That a total of 150 workers could be employed on various smaller projects does not seem unreasonable. A local workforce of approximately 40 percent would also seem to reflect the most realistic assumptions about the nature of the local workforce. As of November 30, 1980 Cascade County had an unemployment rate of 7.6 percent.[6] Many of these are skilled workers who recently lost their jobs as a result of the closure of the Anaconda Copper Refinery here. However, it is very unlikely that those workers will still be available four years from now. Programs are now underway to help these workers find jobs elsewhere.

Once the number of nonlocal workers has been estimated, the next step is to estimate where the workers will choose to live within the commuting region. The Construction Worker Profile found that community size and distance from the project are the two variables that explain much of the variation in the choice of a place of residence. Other variables seemed specific to certain projects and included such factors as provision of housing or transportation by the utilities.[7] A close look

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[6]Great Falls Job Service.

[7]Mountain West Research, Construction Worker Profile, p. 94.

at residential alternatives would lead one to assume that since Great Falls is the closest community to both sites and since there is presently excess capacity in the city, the vast majority of incoming workers would choose to locate in Great Falls. Indeed, the results from applying the community choice model indicate that .9686 percent of all incoming workers would locate in the Great Falls urban area. Six communities were considered in the model. The six communities and number of new construction worker residents are listed in Table 10. The results indicate that at peak construction approximately 588 workers would be residing in the Great Falls urban area according to the assumptions considered most likely.

Table 10

Place of Residence for New Construction Workers[1]

Communities	$\hat{NL}^2 = 350$	$\hat{NL} = 607$	$\hat{NL} = 855$
Cascade	1.3	2.3	3.3
Sun River Valley	1.3	2.3	3.3
Manchester Area	3.8	6.5	9.2
Eden-Stocket Area	2.6	4.4	6.4
Belt	1.9	3.3	4.6
Great Falls Urban Area	339.0	587.9	828.2

[1]Calculations can be found in the Appendix, Table 4.
[2]$\hat{NL}$ refers to the projected number of nonlocal workers.

The population influx associated with nonlocal workers results from the interaction of several factors. These include the proportion of nonlocal workers who are married, the proportion of married workers who bring their families and the size of those families. Regression analysis on the hypotheses which might help to explain whether or not workers brought their families with them such as duration of the project and community size were inconclusive. Therefore, according to Mountain West Research, "the best assumption is that the population influx of 227.8 persons observed in the study is the best available and will characterize other new projects in the region."[8] The population influx at peak construction associated with each of the three scenarios for the Great Falls urban area is shown in Table 11. An explanation of the table can be found in the Appendix, page 87.

Table 11

Population Influx Associated with Nonlocal Construction Workers for the Great Falls Urban Area with Age Distribution of Children

		$\hat{NL}$ 339		$\hat{NL}$ 558		$\hat{NL}$ 838
Single Widowed or Divorced Workers		83		145		204
Married Workers, Family Absent		90		156		219
Married Workers, Family Present		165		288		405
Spouses		165		288		405
Children (Total)		267		463		653
Less than 5	96		166		233	
5-11	97		168		237	
12-14	30		52		74	
15-17	28		49		70	
18-19	9		16		23	
20-24	5		9		12	
25-29	2		3		4	
Total		770		1,340		1,886

The estimated influx of total population into the region by construction quarter for the potential peak workforce and the average workforce are shown in Tables 12 and 13.

[8] Ibid., p. 99.

Table 12

Population Influx by Quarter

Average Workforce

Quarter	Average Force[1]	Nonlocal Workers[2]	Total[3]
1	93	56	128
2	194	118	268
3	321	195	444
4	473	287	654
5	575	349	795
6	710	431	982
7	862	523	1,191
8	938	569	1,297
9	913	554	1,262
10	752	456	1,038
11	515	313	712
12	363	220	502
13	211	128	292
14	150	91	207
15	68	41	94
16	6	4	8

[1]Montana Power Company, "Preliminary Construction Manhour Levels by Quarters, Resource 89," September 5, 1980.

[2]Based on 607 nonlocal workers per 1,000 total workers.

[3]Based on a mean population influx of 227.8 persons per 100 nonlocal workers. Construction Worker Profile, p. 99.

Table 13

Population Influx by Quarter

Potential Peak Workforce

Quarter	Potential[1] Peak Force	Nonlocal[2] Workers	Total[3]
1	150	91	207
2	250	152	346
3	400	242	551
4	550	333	759
5	600	364	829
6	750	455	1,036
7	900	546	1,243
8	1,000	607	1,383
9	950	577	1,314
10	825	501	1,141
11	575	349	795
12	450	273	622
13	250	152	346
14	175	106	241
15	75	46	104
16	25	15	35

[1]Montana Power Company, "Preliminary Construction Manhour Levels by Quarters, Resource 89," September 1980.

[2]Based on 607 nonlocal workers per 1,000 total workers.

[3]Based on a mean population influx of 227.8 persons per 100 nonlocal workers. Construction Worker Profile, p. 99.

Demand for Housing

During the 1970's most of the energy development in the West occurred in sparsely populated areas. Provision of housing for new residents has been a problem for all of the smaller communities affected by large construction projects. Inadequate housing is one of the most serious problems associated with "boomtowns" and the provision of housing is one of the most frequent impact mitigation measures currently being undertaken by utilities.[9]

How the housing preferences expressed by construction workers in the 1975 survey would translate into the three scenarios is expressed in Table 14. The greatest demand is for single family housing and mobile homes. What is not known is the percentage of those workers who prefer living in mobile homes who will bring their own homes with them. Hence from the data it is impossible to forecast the demand for mobile home sites versus the demand for mobile homes.

Two factors which may significantly affect the choice of housing are cost and availability. Cost and interest rates may affect the ability of many families to purchase a single family home even if that is their preference and such units are readily available. On the other hand, in many smaller communities apartments were not available. In a community such as Great Falls where apartments are currently plentiful and rents have declined slightly as landlords have attempted to keep their units full, some preferences may shift from single family dwellings to apartments.

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[9]William C. Metz, "The Mitigation of Socioeconomic Impacts by Electric Utilities," Public Utilities Fortnightly, (September 11, 1980), pp. 34-42.

Table 14

Housing Preferences of Construction Workers for 3 Scenarios

Type of Unit	$\hat{NL}$ 339	$\hat{NL}$ 588	$\hat{NL}$ 828
Single Family	156	270	381
Duplex, Townhouse	3	6	8
Apartment	27	47	66
Mobile Home	129	223	315
Other	27	47	66

Based on housing preferences indicated by construction workers. Construction Worker Profile: Final Report, p. 103.

Schools

From Table 14 it is possible to forecast the number of new students in the city's public schools for each of the three scenarios. Table 14 is an understatement in that the children living in the Manchester area west to Vaughn would also attend local schools. Table 15 includes those children.

Table 15

School Age Children of Construction Workers

Living in the Great Falls School District

Children by Age Groups	$\hat{NL}$ 343	$\hat{NL}$ 595	$\hat{NL}$ 837
5-11	98	170	239
12-14	31	53	74
15-17	29	50	70
	158	273	383

Based on age distribution of children as reported in the Construction Worker Profile: Final Report, p. 101.

According to the data, the most noticeable impact would be on the elementary schools, which under the scenario thought most likely of NL = 595, would gain 170 students at peak construction. If they were not evenly distributed throughout the district, school boundaries would be adjusted to more evenly distribute the increased student load throughout the fifteen elementary schools in the district. Assuming that some classes in the district are underloaded, the school administration uses a ratio of 50:1 instead of the normal 25:1, in budgeting for short term student increases.[10] For the two year duration of the heaviest construction activity, this would necessitate the hiring of only 3-4 additional elementary teachers. Even in the most extreme case, the addition of 240 elementary students would only result in the hiring of five additional teachers. It should also be pointed out that peak construction will occur during the summer months, so that the peak for the school district should be somewhat less than calculated here.

The effect of fifty additional junior high students and fifty additional senior high students would be insignificant when distributed among the city's four junior high schools and two large senior high schools

Earnings and Employment

Economic Base Analysis

Regional economic base theory holds that the economic activities of a region are divided between industries producing for export and industries serving the local market. It is the basic or primary industries which are the major determinants of growth or decline in the local economy.

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[10]Harold Wenaas, Superintendent, School District No. 1.

They provide the means of payment for the raw materials, food and manufactured products which the region does not produce itself and also support the service or derivative activities which are primarily local in productive scope and markets.

Short run changes in the location of some basic economic activity or in the volume of that activity in a region will have a multiple impact on the volume of all employment and income in the region. Loss of income will cause a reduction of employment and income greater than the initial loss, while an increase in exports will cause a gain in income and employment that is likewise greater than the initial gain. The calculation of the impact of primary industries on the local economy depends on the degree to which export workers spend their incomes locally and on the leakages from the local economy via the importing of items not produced within the region. The greater the tendency to import, the less important each successive round of spending. Dollars from basic industry may have little secondary effect when many of them are exported beyond the region to pay for imported goods and services.

An increase in exports will usually cause an increase in income equal initially to the increase in exports. With the increase in incomes households will expand spending by some proportion known as the marginal propensity to consume. Even more important is the marginal propensity to consume locally, which is the marginal propensity to consume less the marginal propensity to import. If, for example, the marginal propensity to consume were 50 percent and the marginal propensity to import were 30 percent, the marginal propensity to consume locally would be 20 percent.

An increase of $100 in exports would cause a total increase of approximately $124. ($100 + .2($100) + .2($20) = $124.)[11]

Unfortunately, data on income for small areas is not available in sufficient detail to work out the above model and calculate the multiplier. Consequently, several alternative methods have been derived for estimating such multipliers. They are generally derived by observing the historical relationship between changes in the general level of export activities and changes in local income and employment. Once such an economic base multiplier is derived, it is often applied to changes in basic activity in order to forecast the growth or decline of employment or income in the region. However, the use of such multipliers in this manner is subject to error. The multiplier value is an average and as such cannot accurately be applied to specific export activities.

Most economists would now argue that analysts should only use multipliers specific to the economic activity being evaluated. Each economic activity has associated with it a multiplier that can be used to predict income changes as a result of changes in that export sector. The effect that the choice of multipliers can have on economic impact studies can be substantial.[12] One should expect the impact of a military base to be different than that of a manufacturing plant because of the differing spending habits of the respective workers.

Consequently most current efforts aimed at calculating multipliers involve disaggregating the economy into sectors and calculating a multiplier

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[11]Hugh O. Nourse, Regional Economics, (New York: McGraw Hill Book Co., 1968), p. 161.

[12]A discussion can be found in J. Holton Wilson, "Impact Analysis and Multiplier Specification," Growth and Change, July 1977, pp. 42-46.

for each sector. The most accurate results are derived from extensive surveying and involve the construction of input-output matrices which not only provide a total multiplier for that sector of the economy, but also indicate how a change in one sector of the economy will effect each other sector. Practically, it is an expensive and time consuming task to calculate all of the ratios from local survey data, hence, the development of many shortcuts and estimating procedures using widely published data. The literature is voluminous, particularly on the various methods of estimating multipliers.[13]

It should also be understood that there are certain limitations to the use of multipliers. Multipliers are generally only useful in understanding the short run impacts of changes in the level of employment or income in a region. Over the long run prices and wages in the region would tend to change, so that the area could adjust to the shift in economic activity. Multipliers are based on past or present data and do not take into account future changes in social, technological or economic conditions which cannot be measured. The prospects for the present and future of a region's export industries must be predicted independently on the basis of other knowledge. Finally, multipliers do not take the time factor into account. Changes in derivative activities are not instantaneous, but a delayed reaction. At the present time there is very little known about the lag time between some change in basic activity in a region and the resultant changes in the derivative sectors of that economy. Hence, at any given

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[13]Almost all of the regional economic journals such as Land Economics, Growth and Change, and the Annals of Regional Science have published numerous studies aimed at accurately estimating sector multipliers from published data.

time the ratio may be influenced by recent changes in primary activities whose multiplier effects have not yet appeared.[14]

Most economic base estimation methods involve assigning industries to basic and derivative categories based intuition or some *a priori* knowledge of a region's industrial structure and external trade flows. The availability of several alternatives suggests the possibility of a range of multiplier estimates. The predicted impact of a given project will vary greatly, simply by varying the way the multipier is obtained.[15] One researcher calculated aggregate base employment multiplier of 6.19, 2.39, 1.99, and 1.64 for Vancouver, B.C., using different estimation techniques and not adjusting the data according to the researcher's own knowledge of the Vancouver economy.[16] Input-output multipliers tend to be lower than those typically estimated using conventional export base ratios. As was suggested by Edward L. Ullman in The Economic Base of American Cities, the differing techniques of estimating multipliers simply help to narrow the range of error in predicting the consequences of changes in economic activity.[17]

Despite these problems research has shown that the larger the city, the more self-sufficient it is. A town of 10,000 is on the average about

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[14]Walter Isard, Methods of Regional Analysis, (Cambridge: Massachusetts Institute of Technology), p. 199.

[15]W. Cleris Lewis, "Export Base Theory and Multiplier Estimation: A Critique," Annals of Regional Science, November 1975, pp. 1-8.

[16]Craig Davis, "Economic Base and Input-Output Multipliers: A Comparison for Vancouver, B.C.," Annals of Regional Science, November 1975, p. 1-7.

[17]Edward L. Ullman, Micheal F. Dacey, Harold Brodsky, The Economic Base of American Cities, (Seattle: Center for Urban and Regional Research, University of Washington Press, 1969), p. 5.

68 percent export and 32 percent derivative or a ratio of one export worker to 1/2 derivative worker. While a very large city such as New York has a ratio of approximately 28 percent export to 72 percent derivative for a ratio of one to 2.6.[18] Regional economists have generally recognized that the larger the city, the more can be produced locally, reducing the need to import and creating a higher multiplier. Some economists would argue that exports are more crucial to small cities than to large ones, as suggested by the amazing stability of cities over 500,000 despite changes in their export activities.[19]

Several considerations must be taken into account and adjusted for by the researcher in the calculation of a multiplier. The first is the industry mix in a given city. If a new industry used locally manufactured products, it would produce a higher multiplier effect than another industry not purchasing locally produced goods. The second is the spending habits of the new industry employees. For example, several studies have substantiated the hypothesis that military installations generally have less economic impact on an area and a lower multiplier than local manufacturing plants. This is because the spending patterns of military personnel differ from their civilian counterparts. Many of their dollars never flow into the local economy because many of the goods and services they would normally be expected to purchase in the local community are supplied for resale on base by the Federal government. The majority of base purchases are also supplied through nationwide government supply channels and do not

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[18]Ibid., p. 7.

[19]Hans Blumenfeld, The Modern Metropolis, (New York, 1967), p. 368, cited by Edward Ullman, et al., The Economic Base of American Cities, p. 9.

impact the local economy. Military personnel tend to be more footloose and more of their dollars tend to be exported in the form of transfer payments.[20] A third consideration is the location of the city in question. Cities remote from the competition of other cities tend to have a higher percentage of wholesale, retail and service employment.[21]

Selecting accurate income and employment multipliers for Cascade County is problematic. While some attempts have been made to quantify multipliers for the state, very little research relating directly to Cascade County is available. Therefore, the approach selected for the purposes of this paper is to estimate the relevant range of multipliers suitable for application in Great Falls given this researcher's own knowledge about the community and based on studies of similar-size cities or regions.

Regional export activity is often measured in terms of employment because of the relative availability of data and the lack of problems inherent in the value measures. Aggregate employment multipliers greater than two are generally considered large and are not supported by the literature unless they apply to very large cities. In the late 1960's Edward Ullman and Micheal Dacey calculated the economic base of hundreds of American cities based on 1950's census data. They found that employment multipliers generally lie in the range of one export worker to one-half to two derivative sector workers.[22] Multipliers were calculated for at least thirty-eight cities in each category. Those with populations closest to

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[20]Walter W. Harris, "The Economic Impact of Malmstrom Air Force Base on Great Falls, Montana," Masters Thesis, University of Montana, 1978.

[21]Edward Ullman, et al., The Economic Base of American Cities, p. 23

[22]Ullman and Dacey, Urban Economic Base.

Great Falls were cities 25,000-40,000 with an average employment multiplier of 1.7 and metropolitan areas of 100,000-150,000 with an average aggregate multiplier of 1.8.[23] Various other studies have calculated multipliers in a similar range as indicated in Table 16.

Table 16

Some Relevant Employment Multipliers

City	Population at time of Research	Employment Multiplier
Oshkosh, Wisconsin[a]	42,000	1.6
Albuquerque, New Mexico[a]	100,000	1.9
Madison, Wisconsin	110,000	1.8
Sioux City, Iowa[b]	100,000	1.8
Elgin-Dundee, Illinois[c]	60,000	1.48
Evanston, Illinois[c]	80,000	1.10
Decator, Illinois[c]	110,000	1.72

[a]Edgar Palmer, The Community Economic Base and Multiplier, (Lincoln, University of Nebraska Business Research Bureau, 1958).

[b]Edward Ullman and Micheal Dacey, "The Minimum Requirements Approach to the Urban Economic Base," Papers and Proceedings of the Regional Science Association, Vol. IV (1960), pp. 175-194 reprinted in the Economic Base of Cities, p. 90.

[c]Ian S. Turner, The Economic Impact of a Military Installation on the Surrounding Area: A Case Study of Fort Devons and Ayer, Massachusetts, Research Report to the Federal Reserve Bank of Boston, Number 30, 1965.

Regression analysis currently being conducted for the Montana Department of Community Affairs has yielded a construction sector

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[23]Ibid., p. 92.

employment multiplier of 2.15.[24] However, this multiplier has not yet been verified and there are several reasons to suspect that it may be high. It is known that the economic impact of temporary construction workers is different than that of resident workers and the department is now working to quantify that difference in the heavy construction multiplier. Most construction activity is of relatively short duration. Businesses and institutions usually have some slack or unused capacity, making it possible for them to absorb higher levels of activity for short periods of time without adding new employees. One study found a one year delay in the employment adjustment of producers to changes in regional demand.[25] Economists are now becoming more cognizant of the role of expectations in business planning. According to the theory of rational expectations, an individual's expectation of future economic conditions is an important determinant of his current choices.[26] The knowledge that an increase in economic activity is only temporary, would according to this theory, be taken into account by the businessman and influence his hiring decisions. In this case, it would tend to dampen the multiplier.

Application of the multiplier tells nothing about the nature, pay scale or duration of the secondary employment likely to be created. However, past research suggests that the majority of those jobs would be in the retail and wholesale sectors. An input-output analysis of the effect

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[24]Phil Brooks, Research Division, Montana State Department of Community Affairs, Helena, Montana.

[25]Daryl Hellman, "A Model of Regional Export Activity," Growth and Change, January 1974, p. 15.

[26]For a discussion of rational expectations theory refer to Bennett T. McCallum, "The Significance of Rational Expectations Theory," Challenge, January/February 1980, pp. 37-40.

of the construction and operation of a nuclear plant in Darlington County, South Carolina found that the principal economic impact resulted from local sales to the construction workforce. Over the three years of construction the project generated 1,912 man years of incremental employment of which only 302 man years were derivative. The majority of those were in the wholesale and retail sector, the financial, insurance and real estate sectors, and the household sector. Only 1.3 percent of all direct purchases for the construction of the facility were made in the county.[27] In Darlington County the multiplier effect of construction was only 1.15.

Many economists prefer income to employment in the calculation of multipliers because the incomes reflect the differences in wage rates and the number of hours worked. However, some of the same considerations apply to income multipliers as to employment multipliers. The number of nonlocal workers on the project will influence the impact of the construction phase. Typically these workers would not be expected to spend as much locally as would resident construction workers. Surveys conducted by Mountain West Research found that newcomer construction workers have a substantially lower ratio than any group surveyed. Local expenditures for this group averaged .496 percent of total expenditures.[28] This figure is further substantiated by the Darlington County study, where fifty percent of construction worker income was taken from the county.[29] The second major consideration is the extent of leakages from the local economy.

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[27]Manuel H. Johnson and James T. Bennett, "An Input-Output Model of Regional Environmental and Economic Impacts of Nuclear Power Plants," Land Economics, May 1979, p. 246.

[28]Mountain West Research, Construction Worker Profile, p. 107

[29]Manuel H. Johnson and James T. Bennett, "An Input-Output Model of Regional Environmental and Economic Impacts of Nuclear Power Plants," p. 246

Virtually everything that one buys in Great Falls from food to capital goods is imported, suggesting large leakages from the local economy which substantially reduce second and third round spending effects.

Income multipliers in the literature range from approximately 1.2 to 2.5 for various sectors. An input-output study of the South Dakota economy found multipliers ranging from 1.2 to 2.16. The multiplier for heavy construction was 1.4.[30] This range was further confirmed by a study of new manufacturing plants in rural Kentucky. Depending on the size of the community and the degree of leakages, the aggregate economic base income multipliers ranged from 1.26 to 2.06.[31]

For reasons already discussed, such as the degree of excess capacity available in the city's businesses and institutions and the likely nature of business expectations regarding the construction period of Resource 89, one would expect a smaller employment multiplier than average, smaller even than the income multiplier. As has already been discussed, some businesses and institutions may be able to absorb increased demand without adding additional employees. An employment multiplier between 1.15 and 1.5 does not seem unreasonable in light of the temporary nature of the construction employment, the likely spending habits of the construction workforce and the amount of leakage from the local economy. Based on a mean of 447 total construction workers over the four year period, one might expect between 67 and 224 additional jobs in the secondary sector.

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[30]Luther C. Thompson, et al., South Dakota Interindustry Linkages: A Static Input-Output Model," pp. 39-43.

[31]Charles Garrison, "The Impact of New Industry: An Application of the Economic Base Multipliers to Small Rural Areas," Land Economics, November 1972, p. 335.

Direct income to the local community is calculated in Table 17. Table 18 indicates how that income would flow into the local economy over the sixteen quarter construction period. Total direct income to the community would total approximately $42 million in 1980 dollars. Using income multipliers ranging from 1.4 to 1.7 based on the literature and the author's own judgement Resource 89 could reasonably be expected to contribute between $59 and $71 million additional dollars to the local economy over the four year construction period.

If the latest income figures for Cascade County which are for 1978 are updated to 1980 dollars, the total construction worker income of $42 million over the four year period would equal only 6.9 percent of the total wages and salaries earned by nonfarm workers in Cascade County in 1978, the latest year for which data are available. Almost one-half of that income will flow into the local economy in the peak year of construction in 1987. That twenty million represents 3 percent of the 1978 total converted to 1980 dollars. The approximately nine million dollars which will be earned in 1986 and 1988 represent 1.5 percent of the 1978 totals.[32]

It should be noted that the $42 million dollar total would be a one-time increase. Once the initiating expenditures are withdrawn and the multiplier process is complete, the level of income will revert to its previous level. The single period of increased expenditures would

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[32]The 1978 total of wages and salaries paid to nonfarm workers is supplied by the U. S. Bureau of the Census. Regional Economics Information System, Bureau of Economic Analysis and equalled $482,857,000. That figure was converted to 1980 dollars using the CPI-W and calculated from July 1978 to July 1980 using information from the U. S. Department of Commerce, Survey of Current Business, Vol 58, No. 12, December 1978, p. S-8 and Vol 60, No. 9, p. 5-6.

not have a permanent effect on the economy, although the multiplier effect of the increased expenditures will remain in the economy for an unspecified period after construction is complete because of the time lag involved in the subsequent rounds of spending.

Table 17

Resource 89 Construction Payroll

Craft Manual	Total[a] Manhours	Hourly Wage[b]	Total
Laborers	324,250	$10.10	$ 3,274,925
Carpenters	231,050	11.25	2,599,312
Operating Engineers	266,255	12.29[c]	3,272,274
Cement Finishers	21,685	11.35	246,125
Electricians	503,795	14.35	7,229,458
Ironworkers	304,685	13.21	4,024,888
Insulators	125,010	12.55[d]	1,568,875
Millwrights	94,400	12.25	1,156,400
Boilermakers	516,325	13.87	7,161,428
Painters	72,845	14.08	1,025,658
Teamsters	78,695	11.28[e]	887,680
Pipefitters	563,595	13.85	7,805,791
Bricklayers	14,710	13.80	202,998
Sheet Metal Workers	51,070	12.88	657,781
Sprinkler Fitters	3,380	13.83	46,745
Mason Tenders	9,965	10.30	102,640
Roofers	8,100	10.75	87,075
Miscellaneous	3,215	11.77	37,841
Total			$37,765,494
Non Manual			
Nonmanual	379,245	(11.77)	$ 4,463,714
			$42,229,208

[a]MPC Preliminary Craft labor as a percentage of total manhours: Resource 89.

[b]Federal Register: Building Projects Vol. 45 No. 126, with Revisions through Oct. 3, 1980, prevailing rates for Cascade County, MT.

[c]Operating Engineers Local #400.

[d]Average for all types of insullating work.

[e]Average for construction only, Teamsters, Great Falls Local #45.

Table 18

Payroll Per Quarter

Resource 89

Quarter	Percent of Total Manhours	Total Payroll 1980 Dollars
1 - 10/1/85 to 1/1/86	1.301	$ 546,420
2 - 1/1/86 to 4/1/86	2.720	1,142,400
3 - 4/1/86 to 7/1/86	4.494	1,887,480
4 - 7/1/86 to 10/1/86	6.623	2,781,660
5 - 10/1/86 to 1/1/87	8.042	3,377,640
6 - 1/1/87 to 4/1/87	9.935	4,172,700
7 - 4/1/87 to 7/1/87	12.064	5,066,880
8 - 7/1/87 to 10/1/87	13.129	5,514,180
9 - 10/1/87 to 1/1/88	12.773	5,364,660
10 - 1/1/88 to 4/1/88	10.526	4,420,920
11 - 4/1/88 to 7/1/88	7.215	3,030,300
12 - 7/1/88 to 10/1/88	5.086	2,136,120
13 - 10/1/88 to 1/1/89	2.957	1,241,940
14 - 1/1/89 to 4/1/89	2.101	882,420
15 - 4/1/89 to 7/1/89	0.946	397,320
16 - 7/1/89 to 10/1/89	0.088	36,960
		$42,000,000

Operations Phase

Population

As has been stated before, most of the socioeconomic impacts of energy development stem directly from a large and rapid population increase. As discussed in previous sections, the magnitude and seriousness of the impact is directly related to the conditions existing in the area at the time the development takes place. Siting the facility near a larger community such as Great Falls can lessen the population-related impacts because of the availability of a larger workforce than would be available in a very small community.

When considering the population-related effects of energy development, it is helpful to look at the ratio of peak construction labor to operating labor. Electric power plants, along with coal gasification plants have the highest ratios of peak construction labor to operating labor of most kinds of energy projects.[33] The ratio for Resource 89, given the currently available information will be 6.25:1. Thus, it is very likely that the community will experience a population loss and some excess capacity once the nonlocal construction workers depart.

Studies have shown that it is generally during the operations phase that local residents have the greatest opportunity to participate in the benefits of energy development.[34] Given the size of the local area, as well as the historical levels of unemployment and outmigration in Cascade County which have been relatively high, it seems most likely that the majority of operations phase workers could be supplied by the local communities, particularly if the community undertakes the kind of training programs that will enable local workers to qualify for these new jobs.

During the operations phase Resource 89 will employ 160 people, 118 of whom will be union employees. While it is highly likely that some management and supervisory personnel will be transferred in, their numbers are not sufficient to noticeably affect the community. Table 19 indicates the operating manpower for Resource 89.

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[33]Irvin L. White, Energy From the West, Vol. I, p. 96.

[34]Ibid., p. 110.

Table 19

Operating Manpower

Resource 89

Classification	Personnel
Management	1
Supervision	19
Administration	10
Operators	44
Mechanics	40
Instruments and Controls	16
Engineering	4
Warehouse Personnel	11
Safety	1
Results and Lab Technicians	7
Fuel Crew	7
	160

Housing

Since the operating phase of Resource 89 will not result in a significant population increase, the effects on housing will be minimal. Given the peak construction to operating employment ratio of 6.25 to 1, it is very likely that as the nonlocal construction workers leave the area, the vacancy rate in the urban area will increase.

To the extent that younger workers who might otherwise leave the community because of lack of employment opportunities, find employment and remain in the community to establish their own households, the effect on housing will be positive, but probably not immediate.

The only immediate impact on housing would come from those supervisory or management personnel who might be transferred to Resource 89.

However, their number is unknown, but probably insignificant, in terms of the total housing stock.

Schools

To the extent that operational phase jobs will primarily be filled by local workers, there is unlikely to be any significant impact on the schools associated with the operations phase of Resource 89; in fact the schools will also likely experience a decline once those nonlocal construction workers depart. The primary determinant of school enrollment figures will be the increase or decline in the birthrate. Most predictions are that the birthrate will increase slightly in the 1980's. Enrollment projections by the Great Falls public school system show declines in enrollment through 1985 and increases thereafter. This will be due to the large number of women in their child-bearing years. The population impact from Resource 89 will not add significantly to these projections.

Earnings and Employment

During the operations phase of Resource 89 the Montana Power Company will employ 160 workers. Experience with past projects has indicated that with the proper educational and training programs the majority of jobs will go to local workers who are either underemployed or unemployed. In attempting to quantify the direct and indirect effects of the operations phase on earnings and employment in the Great Falls area, multiplier selection is once again a problem.

Research at the state level suggests that the ratio of basic to secondary jobs is one to one.[35] From research cited earlier one would

[35]Phil Brooks, Research Division, Department of Community Affairs, Helena, MT.

expect it to be slightly less. However, the multipliers used for the operations phase analysis could reasonably be expected to be larger than those used in the analysis of the construction phase because the vast majority of the employees will be local residents. Survey results printed in The Construction Worker Profile: Final Report, found that residents in the effected communities (all of which were smaller than Great Falls) reported making over sixty percent of their expenditures locally compared to fifty percent for nonlocal construction workers.[36] It must be remembered, however, that the multipliers cited above are aggregate multipliers and may be inaccurate when applied directly to changes in one sector of the economy. Case studies in the literature tend to refute a high secondary employment impact. One study which analyzed the impact of several new manufacturing plants in rural Kentucky between 1958 and 1965 found that the effect of the plants on the nonbasic employment was far less than the effect on incomes. The main reason was that local workers filled the jobs and there was no significant population growth. When communities are not growing there is an apparent tendency for the workforce employed in trade, finance and service firms to be underutilized. These firms can absorb a considerable increase in sales without hiring new workers. For those Kentucky counties studied, the outmigration and population declines were not halted by the addition of new jobs. However, those remaining in the county experienced significant increases in per capita income.[37]

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[36] Mountain West Research, Construction Worker Profile: Final Report, p. 107.

[37] Charles Garrison, "The Impact of New Industry: An Application of the Economic Base Multiplier to Small Rural Areas," Land Economics, November 1972, p. 335.

These results are substantiated in the Darlington County study. Over the three years of operations analyzed, 1,172 man years of incremental employment were generated, the majority of which were in the public utilities and local government sectors. Only 364.6 hours were generated in the other sectors. The researchers reported that the total impact on the county during the years of the study was not enough to alter measureably the socioeconomic structure of the region.[38]

The available data would suggest an employment multiplier of approximately 1.7 which would predict the creation of an additional 112 jobs in the secondary economy. However, in view of the case study results and the excess capacity currently existing in the local economy, this projection should be viewed with extreme caution.

Again the projection also indicated nothing about the nature of the employment likely to be created, its quality or pay rates.

The annual yearly payroll of Resource 89 will be about $4 million in 1980 dollars. The multiplier calculated for the electrical utilities sector of the economy was 1.5 in the South Dakota study.[39] Using an income multiplier of 2 to delineate the upper bounds of the range, it is possible to forecast a total increase in earnings of between the $6 and $8 million in 1980 dollars as a result of the operation of Resource 89.

The annual yearly payroll of $4 million is 9 percent of the total wages paid to utility and transportation workers in 1978 when that amount

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[38] Manuel H. Johnson and James T. Bennett, "An Input-Output Model of Regional Environmental and Economic Impacts of Nuclear Power Plants," p. 248.

[39] Luther C. Thompson, et al., "South Dakota Interindustry Linkages: A Static Input-Output Model," p. 40.

is converted to 1980 dollars and represents only .006 of total nonfarm wages paid in the county in 1978.[40]

However, because the change in the overall level of spending is permanent, it will have a cumulative effect that will result in a new equilibrium level for the local economy that will be slightly higher than the previous level and that will be maintained over time.

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[40]Refer to footnote 32 on page 70 for a discussion of the method used to convert 1978 dollars to 1980 dollars.

VII. RESULTS

Generally, the greater the population and labor force available in a city, the greater its assimilative capacity to accommodate major energy development without adverse impacts. The results of applying the models used in this study to assess the sensitivity of the Great Falls area to Resource 89 suggest that the city would not be an exception. Adverse impacts usually occur because of a sudden large population influx for which the local community is ill-prepared and which severely strains its institutions and facilities. Essentially four measures were used to distinguish the area's sensitivity to the proposed coal-fired generating plant. They were the absolute size of the city, the density of the population, the proximity to the nearest regional trade center and the existing relationship between basic and secondary employment.

The greatest impact generally would occur during construction. Great Falls is larger than most western communities that have experienced large scale energy development. The size of the peak construction work force is not large in proportion to the size of the local population. Probably the key factor in forecasting the likely impact of Resource 89 is to determine the number of nonlocal temporary construction workers who will move into the area. The model used in this study predicts that the local daily commuting area can supply approximately 650 total construction workers for all projects in the area. Hence, the number of those workers who might be employed on Resource 89 is dependent on the number of other projects in the area at the time. At this time it is impossible to forecas with accuracy the number and size of other projects which may be undergoing construction simultaneously with Resource 89. By hypothesizing several possible scenarios a likely range could be established. The number of nonlocal construction workers can be estimated to range from a low of 350 assuming no other projects in the area at the time to a high of 850 assuming another large project, with a most likely estimate of 600. The range for the population influx accompanying the workforce is 770 to 1,886 with the most likely predicted to be approximately 1,340. The model predicts that the vast majority will live in Great Falls and use local facilities, making it highly unlikely that changes in land use patterns will occur, particularly given the excess capacity in the housing sector and the local school system.

To the extent that local workers are employed on the project they will benefit directly. The community as a whole is likely to benefit because of an increase in derivative employment and earnings brought about through the multiplier effect. However, predicting the multiplier effect is problematical and inexact. There is not accurate enough data available to calculate a multiplier based on the spending habits of the local citizenry nor is there sufficient data detailing the amount of leakages from the local economy via the importing of goods and services. Multipliers calculated for the state are helpful in setting parameters on the likely results of changes in economic activity, but cannot accurately be applied to a subeconomy in which one would expect a lower multiplier effect. Therefore, the approach considered most appropriate was to look at case studies and local empirical work in an attempt to narrow the acceptable range. Case study data, research into the spending habits of construction workers, observations in the community as to the amount of importing and the temporary nature of the construction phase combine to suggest a relatively low construction phase multiplier. Because the amount of excess capacity in local facilities and institutions is unknown, as is the precise time lag between the change in economic activity and the secondary effects on employment, the range of appropriate multipliers is relatively wide and suggests additional derivative employment of between 67 and 224 persons over the life of the project. The income multiplier which is thought to be slightly larger suggests that the four years of construction would generate an additional $58 to $71 million in the local economy.

Previous studies have shown that the permanent operations phase jobs usually go to local workers. Cascade County could easily supply those employees. The operations phase provides an opportunity for local workers who are unemployed or underemployed to significantly improve their situations. Because it is likely that the vast majority of jobs could be filled by local workers there would be no immediate effect on housing or schools.

Because residents tend to have a greater propensity to spend their dollars locally than do temporary workers, the multiplier should be larger for the permanent operating phase. However, the problem of leakages still remains. Resource 89 would create 160 permanent employment positions with an annual payroll of 4 million 1980 dollars. Predicting the eventual secondary employment effects is difficult for the reasons already discussed, and the prediction should be viewed with caution. However, it does not seem unreasonable to forecast that an additional 112 jobs in the derivative sector could be generated over time. A yearly increase in total earnings of $6 to $8 million (1980 dollars) also seems most reasonable.

Conclusions

This study has shown that the proposed construction and operation of a 350 megawatt coal-fired generating plant will not impact the community significantly. The major effect is likely to be an increase in the economic well-being of the local citizenry. Past research suggests that the more local workers that can be employed, particularly during the construction phase, the greater the economic benefits to the community. This is largely because of the differing spending habits of residents as opposed to temporary workers. The experience of other communities would indicate that the percentage of local workers employed on the project can be increased if local training programs in the specific skills needed for the project are initiated prior to construction. Because construction would not begin until 1985, there is ample time for local institutions to initiate such programs, to improve the opportunities for local workers to obtain employment, both during construction and operations.

Because Great Falls is the major retail trade center in central Montana it should experience a greater secondary effect from Resource 89 than a much smaller community. The economic benefits will be greater during the construction phase than during the operations phase of the project and most residents will experience indirect rather than direct benefits. Benefits will accrue because of the capacity in the community to absorb the population influx without having to provide significant additional services or facilities.

The nature of the secondary employment impact remains problematical but to the extent that case studies provide useful insights it is likely to be confined largely to the retail and wholesale sectors of the economy.

There may be another significant impact associated with the location of Resource 89 in the Great Falls area. Resource 89 might result in a small but important step in the diversification of the local economy. While Resource 89 itself would not result in significant diversification, the possibility exists that other energy projects such as an MHD facility or a second generating plant could be attracted to the community by Resource 89. While not documented, psychological effect could also be important. It is possible that several projects which have apparently been delayed as a result of previous negative economic news of the cutbacks at Malmstrom and the closure of the Anaconda Company may receive a new impetus through the anticipation of increased economic activity which might be brought about by Resource 89.

The coal resource and its effect on the community have not been discussed because very little information is currently available. Until the coal source is announced it is impossible to predict whether the community would benefit directly from local sources, indirectly from sources up to 100 miles away in the Stanford area or not at all if coal were to be imported from eastern Montana. Local mining of coal would likely expand significantly the economic impact of Resource 89.

VIII. APPENDIX

Source of Supply Model[1]

An estimation of the number of nonlocal workers was made using the results of regression analysis conducted by Mountain West Research, Inc. The empirical results are as follows:

$$LW_{ij} = 12.723 + .0024C_i + .055P_j - .006D_{ij} - .1720P - .00030C$$

where:

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

C_i = the population of community i.

P_j = the total number of employees on the project.

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

OC = the aggregate population of other communities within the commuting region.

OP = the total employment on other projects within the commuting region.

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[1]Mountain West Research, Inc., Construction Worker Profile: Final Report, p. 84.

TABLE 20

DATA USED IN TABULATING THE

SOURCE OF SUPPLY MODEL

Town or Division	C_i	D_{ij}	OC	P_j	OP		
Cascade	760	33	80,345	1000	0	150	500
Sun River Valley Division	605	27	80,500	1000	0	150	500
Manchester Division	1,212	17	79,893	1000	0	150	500
Eden-Stockett Division	841	17	80,264	1000	0	150	500
Belt	789	23	80,316	1000	0	150	500
Great Falls Urban Area	69,500	10	10,605	1000	0	150	500
Fort Benton	1,697	40	79,408	1000	0	150	500
Conrad	3,074	70	78,031	1000	0	150	500
Augusta	840	78	80,265	1000	0	150	500
Choteau	1,789	72	79,316	1000	0	150	500

SOURCE: Great Falls City County Planning Department.

TABLE 21

POPULATION INFLUX FOR 100 NONLOCAL CONSTRUCTION WORKERS

WITH AGE DISTRIBUTION OF THEIR CHILDREN

		Number of Persons
Single, Widowed or Divorced Workers		24.6
Married Workers, Family Absent		26.5
Married Workers, Family Present		48.9
Spouses		48.9
Children (total)		
less than 5	28.2	
5 - 11	28.6	
12 - 14	8.9	
15 - 17	8.4	
18 - 19	2.8	
20 - 24	1.5	
25 - 29	.5	
Total		227.8

SOURCE: Mountain West Research, Inc., Construction Worker Profile: Final Report, p. 101.

The Community Choice Model

The Community Choice Model is based on the idea that the attractiveness of a community (A_i) as a place of residence for nonlocal workers from the jth project is related to the size of the community (C_i) and to the distance separating the community and the project (D_{ij}).

$$A_i = \frac{C_i}{D_{ij}^{\beta}}$$

where β = the distance elasticity

Assuming the region is similar to the fourteen projects in the Project Survey, the parameter estimate of $\hat{\beta}$ = .849 was used. By summing the A's and then taking a ratio of each to the total, the following allocation factors were derived for those communities selected as likely places of residence for the nonlocal construction workforce.[2]

Community	Allocation Factor
Cascade	.0038
Sun River	.0038
Manchester	.0107
Eden-Stockett	.0075
Belt	.0054
Great Falls Urban Area	.9686

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[2]Mountain West Research, Inc., Construction Worker Profile: Final Report, pp. 90-96.

TABLE 22

HOUSING PREFERENCES OF NONLOCAL

CONSTRUCTION WORKERS

Type of Unit	Percentage Preferred
Single, Family	.46
Duplex, Townhouse	.01
Apartment	.08
Mobile Home	.38
Other	.08

SOURCE: Mountain West Research, Inc., Construction Worker Profile: Final Report, p. 103.

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