



AgEcon SEARCH
RESEARCH IN AGRICULTURAL & APPLIED ECONOMICS

The World's Largest Open Access Agricultural & Applied Economics Digital Library

This document is discoverable and free to researchers across the globe due to the work of AgEcon Search.

Help ensure our sustainability.

Give to AgEcon Search

AgEcon Search

<http://ageconsearch.umn.edu>

aesearch@umn.edu

*Papers downloaded from **AgEcon Search** may be used for non-commercial purposes and personal study only. No other use, including posting to another Internet site, is permitted without permission from the copyright owner (not AgEcon Search), or as allowed under the provisions of Fair Use, U.S. Copyright Act, Title 17 U.S.C.*

FISCAL IMPACT OF A NEW INDUSTRY IN A RURAL AREA: A COAL GASIFICATION PLANT IN WESTERN NORTH DAKOTA

Arlen G. Leholm, F. Larry Leistritz, and Thor A. Hertsgaard*

Large-scale development of energy resources may have a profound effect on the economy, institutional fabric, and social structure of the sparsely populated western counties of North Dakota. The community problems related to development of a coal gasification plant arise primarily from the rapid influx of large numbers of people into a sparsely populated region. In North Dakota none of the proposed sites for gasification plants are within 35 miles of a town larger than 1,500 people. Rural communities often have sought to attract industry in the belief that it will produce an increase in public revenues. However, industrialization may be a fiscal detriment to local government if the revenues it produces are not as large as the additional public costs created by the industry and its resulting population increase [14]. Garrison [7] reports that the establishment of new manufacturing plants in five towns had a negative fiscal impact (i.e., additional public costs exceeded additional public revenues) on most local government units. Crowley [2] finds that in-migrants to cities initially impose a net fiscal burden. Smith [22] reports that overbuilding of public facilities in response to a major dam construction project led to substantial increases in public costs and tax rates in an Oregon community. On the other hand, Youde and Huettig [24] estimate that establishment of a meat packing plant in a rural Oregon community would result in a positive fiscal impact (i.e., additional tax revenues exceed additional costs) on local government.

Most previous studies have failed to consider either all of the added service costs, all of the added revenues, or both. A common practice has been to consider the added revenue produced by the plant and compare this to the added service costs attributed to plant workers [7, 14]. This approach ignores tax revenues from workers' residences and other property. The secondary (indirect and induced) effects of industrial expansion also often have been ignored in previous studies, although there is evidence that these effects may be important in determining the overall net fiscal impact of a major new development.

*The authors are respectively, Research Associate, Associate Professor, and Professor in the Department of Agricultural Economics, North Dakota State University.

In an analysis of fiscal impacts of industrialization on school districts, Hirsch [9] considered indirect and induced effects and concluded that, unless state school aid transfer payments were considered, 13 of the 16 industry expansion cases studied would have a negative net fiscal impact on the school district. If increased school aid payments were included in school district revenue, then 10 of the 16 expanding industries would produce a positive fiscal impact. This study also indicates the importance of residential property as a source of local tax revenues. For all but one of the 16 industries examined, tax revenues from residential property increased more than did revenues from industrial and commercial property as a result of industrial expansion.

The need for a model which local decision makers can employ to project the fiscal impact of a proposed new industry is apparent. A recent study by Kee [12] suggests that such a model must consider the nature of the labor force (income and number of dependents per worker), nature of the industry (especially the capital-labor ratio), residential patterns of the work force (location and type of housing), and the incremental costs of school and other services required.

The purpose of this paper is to report on the development of a model for ex ante evaluation of the effect of a new industry on public sector costs and revenues. Cost and revenue impacts are evaluated for both local and state levels of government during two time periods--the period of plant construction and the period of plant operation. The model considers the direct effects of the new industry and also the indirect and induced effects. Application of the model is demonstrated using the example of a coal gasification plant (several of which are proposed for construction in western North Dakota).

The Model

Adequate evaluation of a new industry's fiscal impact requires a model which reflects the interrelationships of business, household, and government sectors. Past analyses often have considered only the revenues received directly from the new development and the costs which can be assigned to it directly. The inadequacy of this approach is demonstrated by Hirsch [9]. The model developed in this paper employs an input-output interdependence coefficient matrix to trace sector interrelationships.

A second major feature of the model is the consideration of cost and revenue timing. When large developments are built in rural areas, a frequent problem is that public costs both for construction of new physical facilities and for more intensive operation of existing facilities increase immediately. However, increased public revenues to finance these facilities typically do not become available until some time after they are needed. This may create serious short-term difficulties for impacted communities [8]. Timing of costs and revenues is treated by separate analyses of the plant construction and plant operation periods.

The model has two major components--a set of regional input-output coefficients and a set of cost and revenue estimators. In concept, the model is similar to that of Hirsch [9]. However, while the Hirsch model considers

only one governmental unit (the local school district), both state and local levels of government are incorporated in this model.¹

The input-output model employed was derived from primary data collected by personal interview from firms and households in southwestern North Dakota. The model was developed by Sand [20] and the coefficients were subsequently tested for validity by Senechal [21]. The model has 13 sectors and is closed with respect to households.² The input-output model is used to estimate the indirect and income induced changes in business volume, employment, and income. These estimates provide the basis for calculating public sector costs and tax payments.

General Assumptions

1. Decision making and fiscal units of concern are local (school district, municipal, and county) and state government.
2. Public sector revenues are based on the North Dakota tax laws that were in effect in 1974. All public revenues and costs are computed on the basis of 1972 prices.
3. During the time period under consideration, the area's industrial structure and technology and the local purchase-import mix of inputs do not change.
4. Estimation of increased local gross business volume obtained through use of the interdependence coefficients of the input-output model assumes that the effects of the initial stimulus have had time to work themselves out.
5. Added household revenues resulting from direct plant payroll and from indirect and induced effects represent a net gain to the state as new employees will either be in-migrants or persons presently unemployed or not in the labor force.

The Detailed Model. For greater ease of exposition, the model is divided into two submodels--one which relates the new industry to changes in public revenue and the other which relates it to changes in public costs.

¹In an earlier article, Hirsch [10] presented a conceptual model for net fiscal impacts on both state and local governments. Application of this more inclusive model was not attempted.

²The sectors are: (1) agriculture--livestock production; (2) agriculture--crop production; (3) mining; (4) contract construction; (5) transportation; (6) communications and public utilities; (7) agricultural processing and wholesaling; (8) retail trade; (9) finance, insurance and real estate; (10) business and professional services; (11) personal and social services; (12) households; and (13) government.

The revenue submodel (Figure 1) begins with the initial economic stimulus provided by the operation of the plant. This direct stimulus occurs through local expenditures of the plant for labor, materials, and various services and utilities. Local expenditures generate additional gross business volume in the local economy and the magnitude of the increase is estimated through use of input-output interdependence coefficients. These estimates of increased gross business volume of the various sectors are used in subsequent estimation of area employment, population, and tax base changes.

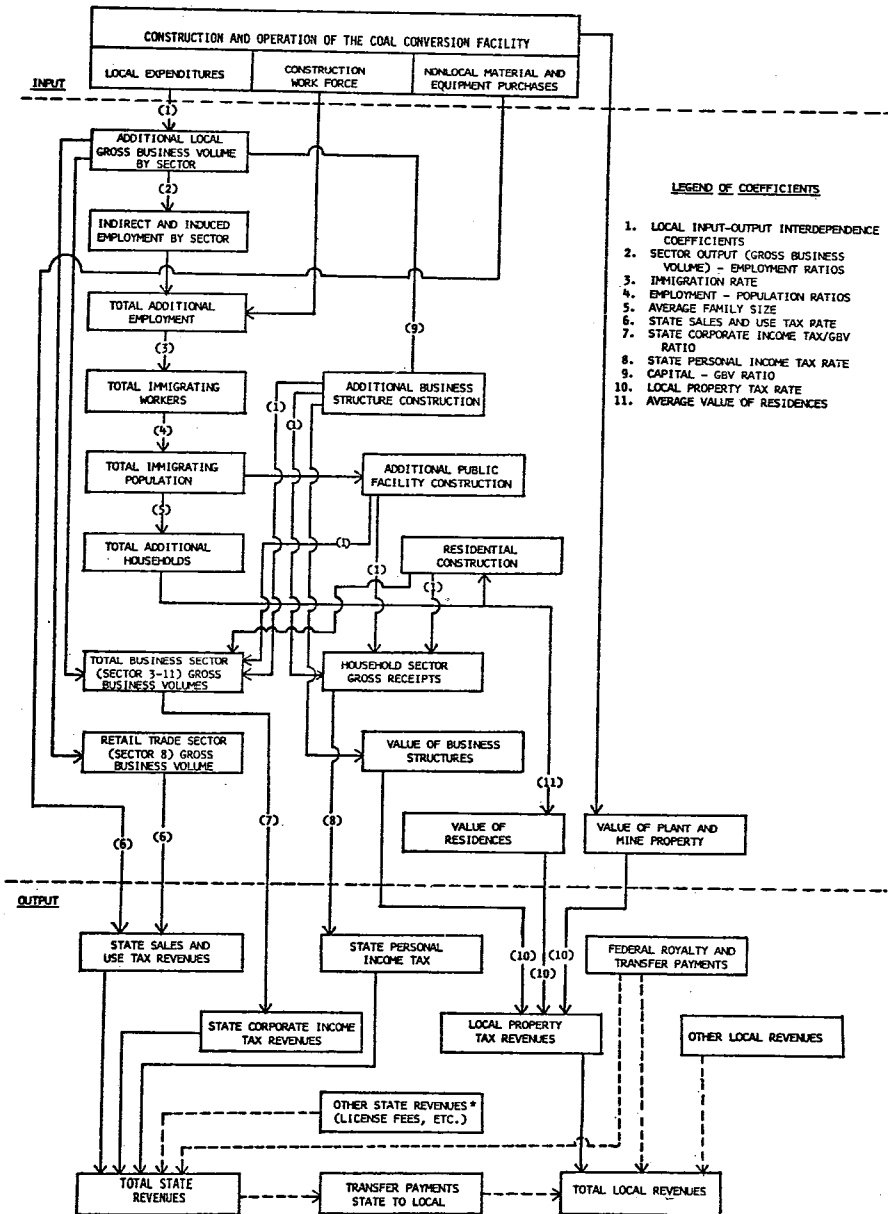
Additional employment (indirect and induced) is estimated for each economic sector, except the household sector, by dividing the increased gross business volume of the sector by that sector's ratio of gross business volume to employment. Estimates of the total additional employment (direct plus indirect and induced) resulting from the new plant's operation provide the basis for estimating the additional population of the area and the number of additional households. The number of additional households then provides the basis for estimates of increased residential property value.

Revenues are estimated for both state and local levels of government. Under North Dakota's 1974 tax laws, state revenues came primarily from sales and use tax, personal income tax, and corporate income tax [6]. State sales and use tax revenues are estimated by applying the sales tax rate to the additional gross business volume of the retail trade sector. Personal income tax receipts are estimated by applying the income tax-income ratio (total state personal income tax collections ÷ total state personal income) to the added personal income (direct, indirect, and induced) resulting from plant operation. The change in gross receipts of the household sector is assumed to be equivalent to increased personal income. State corporate income tax revenue is estimated by applying the corporate income tax-gross business volume ratio (corporate income tax collections ÷ gross business volume of all nonfarm business sectors) to the total increased gross business volume of all nonfarm business sectors. Corporate income taxes collected directly from the new plant are estimated separately. Other state revenue sources include the vehicle fuel tax and various excise taxes and a portion of royalty payments made by mining firms to the federal government.³ However, the revenues from these sources have not been estimated.

The principal source of local government revenues in North Dakota is the ad valorem property tax which accounted for more than 95 percent of all locally collected taxes in 1972 [6]. The estimate of added property tax revenue is developed by applying the property tax rate to the taxable value of the new plant and its ancillary facilities (in this case, pipelines and a coal mine) and also to the value of added business and residential structures. Other sources of financial support for local governments include (a) other local tax collections, including estate tax; (b) transfer

³Under the provisions of the Mineral Leasing Act of 1920, 37 1/2 percent of federal mineral royalty collections are returned to the respective states.

FIGURE 1. FLOW CHART OF REVENUE ESTIMATION FOR A COAL CONVERSION FACILITY, NORTH DAKOTA



*INCLUDES COAL SEVERANCE TAX AND TAXATION OF CONVERSION FACILITIES.

DASHED LINES (---) REPRESENT REVENUE FLOWS NOT ESTIMATED BUT INCLUDED FOR CONCEPTUAL COMPLETENESS.

payments from state government; and (c) transfer payments from federal sources. Transfer payments constitute a significant source of support, but estimation of the effects of a new industry upon the magnitude of these payments requires a complex set of assumptions. Consequently, while these payments are included in Figure 1 for conceptual completeness, their magnitude has not been estimated.

The cost submodel is shown in Figure 2. As in the revenue submodel, the initial stimulus provided by the new plant generates increases in gross business volume and increases in employment and population. Increased population, in turn, generates added demands on public services. Public costs increase at both state and local levels; however, the local cost increases are the area of greatest interest. Estimates of operation and maintenance costs of public services are based on the estimated population increase.⁴ Capital costs arising from the construction of new service facilities also are related to population increase--taking into account any excess capacity in present facilities. In many rural areas, existing excess capacity may be substantial in relation to increased needs; and, where this is the case, the effect on local costs and thus on the local net fiscal resources could be considerable.

Model Application

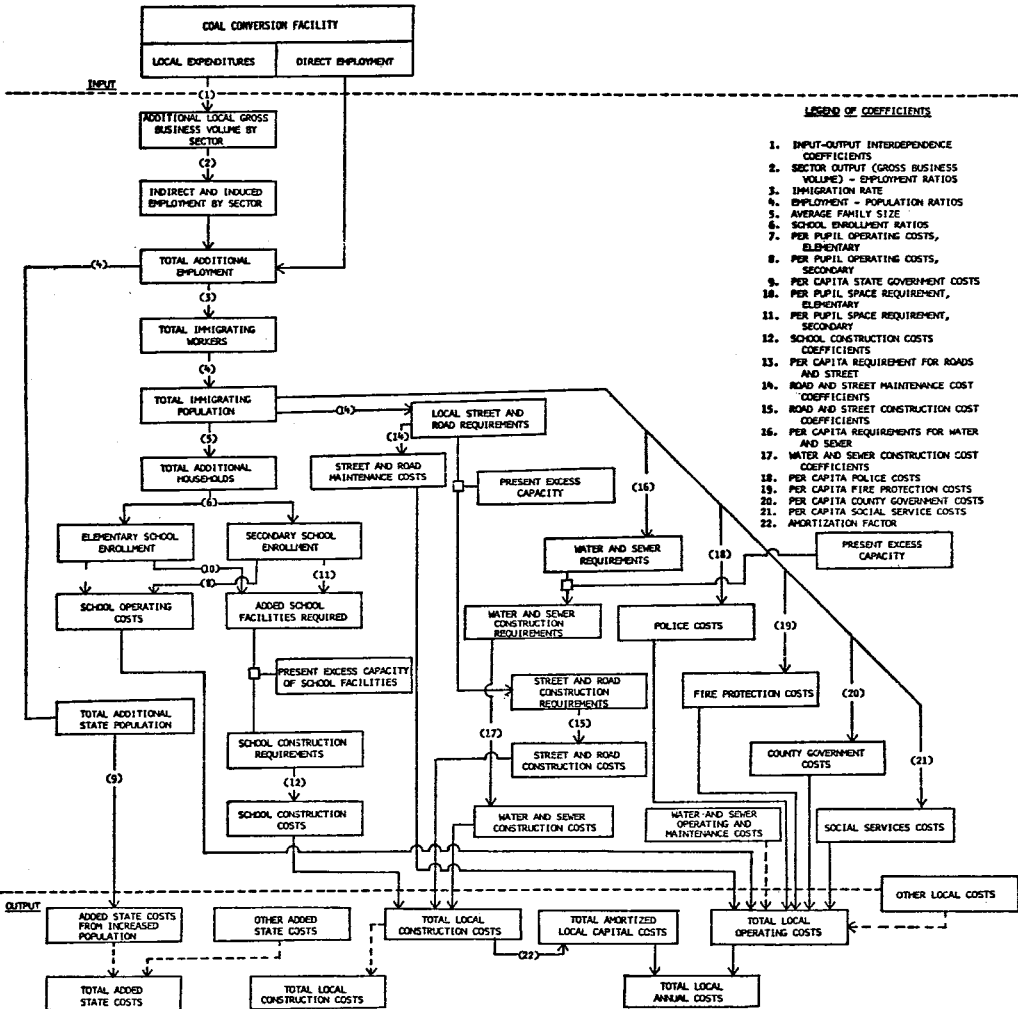
The model was applied to the situation of a large coal gasification plant to be located in western North Dakota.⁵ Because a number of coal gasification and electric generating facilities have been proposed for construction in the Northern Great Plains States [4], the gasification plant provides a useful and timely example of a major industry locating in a rural area. Mercer County, North Dakota, was the assumed site of the plant. This county has been designated as the location of a plant proposed by the Michigan-Wisconsin Pipeline Company and expected to go into operation in 1981 [15]. Mercer County also is believed to be representative of many of the potential locations for coal conversion complexes in the Northern Great Plains States.⁶ Mercer County can be characterized as a sparsely populated rural community. In 1970, the

⁴As the per capita cost for many public services may be dependent on income and a variety of other socioeconomic variables, this approach may be overly simplistic. However, other relevant variables can be incorporated into the model if this appears desirable.

⁵The model also has been applied to electric generating plants and to mines producing coal for shipment to other areas. The results of these applications are not reported in this paper because of space limitations.

⁶For detailed information on the potential magnitude and location of Northern Great Plains coal development, see Northern Great Plains Resources Program [17].

FIGURE 2. FLOW CHART OF COST ESTIMATION FOR A COAL CONVERSION FACILITY, NORTH DAKOTA



DASHED LINES (---) REPRESENT REVENUE FLOWS NOT ESTIMATED BUT INCLUDED FOR CONCEPTUAL COMPLETENESS.

population was 6,175 and the population density was 5.6 persons per square mile. The largest towns in the county are 1,500 and 1,200 people, respectively.

The plant will convert lignite coal to synthetic pipeline gas using 12 million tons of coal annually and producing 250 million cubic feet of synthetic gas per day. The plant was assumed to employ 625 full-time workers when in full operation and the mine to fuel it about 300. Construction of the plant was assumed to take about three years with an average of 2,200 construction workers employed.⁷ Estimates of local expenditures (include such items as labor supplies, maintenance materials, fuel and lubricants) developed by Dalsted [5] were used as input for the model.

Indirect and induced employment was estimated to total about 1,400 during the operation phase; whereas, indirect and induced jobs were expected to average about 3,200 during construction. Thus, total additional employment was estimated to be about 5,400 during construction and about 2,300 during operation.⁸

During the construction phase, 50 percent of the direct employees and 25 percent of the indirect workers were assumed to migrate into Mercer County giving a total of 1,904 immigrating workers. During the operation phase, 50 percent of both direct and indirect workers were assumed to immigrate into the county giving a total of 1,161 immigrating workers during the operation phase. The remainder of the direct work force was expected to be comprised of locally hired workers or intercounty commuters; while the remainder of the indirect workers will include workers hired locally, commuters, and workers whose jobs will be located outside the county.⁹

The ratio of population to employment was estimated to be 2.65 based on the historic trend in North Dakota's population-employment ratio. The average family size was assumed to be 3.25 persons (the average family size for North Dakota according to the 1970 United States Census of Population).

Revenue Determination. Added public revenues resulting from construction and operation of the new plant were estimated for both local and state government. Local revenues from property taxes were estimated, but local revenues from other sources were not. State revenues from sales and use tax, personal

⁷Work force requirements are from industrial sources and United States Bureau of Mines reports. For a detailed discussion see Dalsted [5].

⁸Indirect and induced employment resulting from operation and construction of the gasification plant and mine was estimated by dividing the added gross business volume of each economic sector (except the household sector) by the sector's ratio of gross business volume to employment (gross business volume per worker) as shown in Figure 1.

⁹The settlement and commuting patterns of the direct and indirect work force were based on the experiences of antiballistic missile system (ABM) impact on Langdon, North Dakota, surveys of the construction and operating North Dakota coal industry work force, and labor availability in the proposed coal impact area.

income tax, and corporate income tax were estimated, but state revenues from other sources (e.g., motor fuel tax, excise taxes, etc.) were not.

The residences of the new workers were assumed to be either mobile homes, apartments, or detached single family dwellings. During the construction phase, it was assumed that one-third of the migrants would live in apartments and two-thirds would live in mobile homes; whereas, during the operation phase, the residential pattern was assumed to be one-third mobile homes, one-third apartments, and one-third houses. The average values in 1972 prices of these different types of housing were estimated from information obtained from local mobile home dealers and from the Fargo-Moorhead Home Builders' Association. Local revenue from residences was estimated by applying the county average property tax rate (i.e., \$1.65 per \$100 of market value).¹⁰

The estimated value of additional business structures was based on the finding of Prestgard [19] that the North Dakota average investment in taxable real property is \$0.22 per dollar of annual gross business volume. This ratio was applied to the total gross business volume of all nonfarm business sectors to obtain the estimated value of additional business structures. The total plant and mine investment was taken from Dalsted [5]. After discussion with State Tax Department officials, it was estimated that about 15 percent of plant investment and 10 percent of mine investment would be classified as taxable real estate under the state's 1974 tax laws. The average property tax rate (\$1.65 per \$100 market value) then was applied to the value of business structures and plant and mine taxable real estate.

State personal and corporate income tax collections were estimated by applying ratios, developed by Prestgard [19] of \$1.15 per \$100 of personal income and \$0.113 per \$100 of gross business volume of all nonfarm business sectors.

Cost Determination. The magnitude of increase in public service costs for local governments will depend primarily on the size of the population increase and the capacity of the existing infrastructure to absorb more people. The greater the number of new residents and the less developed the pre-existing set of public services in the area, the greater will be the expenditures required to provide public services. This analysis assumed no excess capacity in any of the public services in Mercer County. Accordingly, estimates of increases in public costs were based on the expected increase in population or the expected number of additional users of a particular service (e.g., public schools).

School enrollment projections were based on a pupil population ratio of 0.25--or an average of 0.81 pupils per family.¹¹ The proportion of secondary students was important because costs per pupil are substantially higher for

¹⁰A detailed discussion of all data sources and estimation procedures is contained in Prestgard [19].

secondary schools. Of the total school enrollment, 32 percent was assumed to be in secondary schools (grades 9-12). This was the average ratio for North Dakota in the 1971-72 school year.

Operation of a coal gasification plant was expected to result in the addition of 769 students to the Mercer County school system. Average per pupil operating costs for the expanded school system were assumed to be equal to the statewide average for school districts having comparable numbers of students enrolled [18].

The additional school enrollment was assumed to require construction of additional physical facilities. Average space requirements were estimated to be 92.5 and 145.0 square feet per pupil for elementary and secondary schools, respectively. Construction costs were estimated to be \$23 per square foot in 1972 prices. This results in a total school construction expenditure of \$1,933,104. Amortized over 20 years at 7 percent interest, this represented an annual repayment and debt servicing obligation of \$182,485 (or \$59.31 per capita for the additional population).¹²

Street construction and maintenance costs were estimated using procedures similar to those used for education. A population density of 15 persons per acre in blocks 300 feet square with 66-foot wide cross streets was assumed. Total maintenance costs were estimated by multiplying the number of street miles by average maintenance costs per mile obtained from the North Dakota State Highway Department [16]. Costs of constructing new streets and resurfacing existing streets to cope with increased traffic volumes were estimated based on current engineering standards and 1972 materials costs [13].¹³

Police protection costs per capita were assumed equal to a weighted average of police costs incurred by North Dakota's six largest cities. Fire protection costs were assumed equal to a weighted average of costs for four cities (Fargo, Grand Forks, Bismarck, and Jamestown) [11]. The estimated costs were \$16.93 per capita for police and \$12.33 per capita for fire protection.

¹¹The primary and secondary enrollments for the 1971-72 school years were compared to 1970 population. The ratios were 0.25 for Mercer County and 0.24 for the state of North Dakota.

¹²School buildings and related facilities can be expected to have a useful life greater than 20 years. For example, Hirsch [9] uses a repayment period of 50 years. However, when industry locates in a rural area, it should be remembered that the new public facilities may have little value if the plant should close. Hence, a repayment period for public facilities which is at least no longer than the expected life of the plant seems desirable. The gasification plant is expected to have a useful life of about 30 years [15].

¹³Costs of street construction and resurfacing were amortized over 20 years at 7 percent interest.

Costs of the county government functions often described as "general government" (e.g., board of commissioners, county auditor, states attorney, etc.) were estimated based on a study by Belter [1]. The cost data used by Belter were averages for the 1960-69 period. The cost estimates obtained from the equation were inflated to the 1972 price level.

Costs of social services were assumed equal to per capita cost of these services for Mercer County in 1972 [23].

Operation, maintenance, and capital costs for water and sewer systems and solid waste disposal typically are charged as user fees. Thus, changes in the costs of these services ordinarily would not affect the tax levies of the local governments. Additional costs for construction of expanded water treatment and distribution systems and expanded waste water systems were estimated by Prestgard [19], but were not included in this paper. Increased costs for maintenance and improvement of intercity roads and highways were not estimated as motor fuel taxes and special excise taxes were expected to offset most of these costs.

There are several other public services financed from local sources, including libraries, parks, and other recreational facilities. (These costs were grouped as "other local costs" in Figure 2). Because the requirements for these services vary greatly depending on various site-specific factors and because they represent a relatively minor portion of total local expenditures, these costs have not been estimated in this study.

Increased state government costs may be divided into those costs arising primarily from population growth and those arising from other sources. The latter category includes added costs incurred in monitoring plant and mine compliance with various state environmental protection laws and added costs of highway maintenance. However, these costs were expected to be offset by license fees collected from the plant and mine and by added motor fuel tax revenues. Hence, estimates of these cost increases were not presented. Costs for state general government functions were assumed to be constant per capita and the estimated increase in these costs was based on average per capita costs for the 1972 and 1973 fiscal years. State government costs, excluding highway expenditures and intergovernmental transfers, averaged \$277.40 per capita in North Dakota for the 1972 and 1973 fiscal years [3]. Given a population increase of 6,153 associated with operation of the gasification plant, state government costs are estimated to increase by \$1.71 million. The corresponding figure for the construction phase is \$3.98 million.

Findings and Conclusions

Tax revenue, public cost, and net fiscal impact estimates for construction and operation of a coal gasification plant are presented for state government in Table 1 and for local government in Table 2.

State Fiscal Impact. State revenues from personal income tax, corporate income tax, and sales and use tax are expected to total almost \$24 million during the three-year construction period with sales and use tax on the materials and

TABLE 1: Increased Revenues and Costs of State Government Resulting from Construction and Operation of One Gasification Plant, North Dakota (1972 Prices)

Item	Construction Phase (\$1,000)	Operating Phase (\$1,000)
One-Time Tax Revenues: ^a		
Total	23,748	-----
Annual Average ^b	7,916	-----
Annually Recurring Tax Revenues ^c	-----	3,202
Annual State Government Costs	3,980	1,707
Net Fiscal Impact (revenues minus Costs):		
Annual	3,936	1,495
Total ^d	11,808	44,850

^aIncludes personal income tax, corporate income tax, and sales and use tax receipts during construction phase and also income and sales tax from business structures and public facility construction for operating phase.

^bAverage for a three-year construction period.

^cIncludes sales and use tax, personal income tax, and corporate income tax.

^dAssumes construction phase of three years and operation phase of 30 years.

TABLE 2: Net Fiscal Impact on Local Government of Construction and Operation of a Coal Gasification Plant by Year, Mercer County, North Dakota (1972 Prices)

Year	Revenue ^a	Current Operating Cost ^b	Capital Improvements		Fiscal Balance ^e	
			Original Cost ^c	Repayment and Debt Service ^d	Current	Cumulative
(\$1,000)						
Construction Phase ^f						
1	-0-	587	2,780	---	-587	-587
2	449	1,173	2,780	262	-986	-1,573
3	1,013	1,173	-0-	525	-685	-2,258

Operating Phase						
4	1,363	608	818	525	+230	-2,028
5	1,363	608	-0-	602	+153	-1,875
:						
10	1,363	608	-0-	602	+153	-1,110
:						
15	1,363	608	-0-	602	+153	-345
:						
20	1,363	608	-0-	602	+153	+420
:						
25	1,363	608	-0-	-0-	+755	+3,099
:						
30	1,363	608	-0-	-0-	+755	+6,874
:						
33	1,363	608	-0-	-0-	+755	+9,139

^aIncludes all local government (municipal, school district, and county) revenues from property tax collections.

^bIncludes operating and maintenance costs for schools, streets, fire and police protection, social services, and general government services.

^cMajor capital improvements are schools and streets. Capital improvement estimate for operation phase assumes that two-thirds of housing for operation phase workers is housing used in construction phase.

^dAssumes that needed public facilities are constructed in first two years of construction period and first year of operation period. Repayment and debt service for a given facility begins the year after it is built with a 20-year repayment period and 7 percent interest.

^eFiscal balance is difference between current revenue and the sum of current operating cost and repayment and debt service payments.

^fConstruction phase revenue estimate is based on the assumption that one-half of taxable residences and business structures associated with the construction phase are built in year 1 (first taxed in year 2) and one-half in year 2 (first taxed in year 3) and also that 30 percent of taxable value of plant and mine is constructed in year 1 (first taxed in year 2) and 40 percent in year 2 (first taxed in year 3).

equipment for plant construction accounting for about 75 percent of the total. State revenues are estimated to exceed state costs by almost \$12 million during the construction period. During the operation period, annual state revenues are estimated to be \$3.2 million (Table 1). The net fiscal impact for state government is positive in the operation phase also, amounting to \$1.5 million annually for a total of \$45 million during the 30-year period of plant operation. Thus, increased state government revenues are estimated to exceed increased costs by more than \$56 million over the lifetime of the plant. However, it should be noted that transfer payments were not included in the calculation of state fiscal impacts. In recent years, the state has made substantial payments to school districts. If the allocation policies used in recent years were continued, state transfers to local schools would be increased by about \$450,000 annually during the operation phase of the project. Even larger payments could be expected during the construction phase. Such transfer payments would reduce the net fiscal gain of state government and provide a corresponding increase in fiscal resources available to local government.

Local Fiscal Impacts. Local tax revenues were estimated to be much less than local costs during the period of plant construction. Local tax revenues were estimated to increase by \$449,000 in year 2--of which \$100,000 was tax revenues from new residences and business structures and \$349,000 was revenue from property tax on the plant and related facilities (Table 2). In year 3, local tax revenues from the plant, new business structures, and residences were estimated to be \$1,013,000 of which \$814,000 was tax on the plant. However, added revenues fell short of added local costs. Additional operating and maintenance costs for schools, fire and police protection, social services, streets, and general local government functions are estimated to amount to \$1,173,000 annually. At the same time, the local governmental units will be required to make substantial capital improvements. When repayment and debt service costs were added to the operating and maintenance costs, the net fiscal impact was negative and exceeded \$2 million at the end of the construction period.

During the operation period, the local fiscal situation was much improved because the entire taxable value of plant and related facilities was added to the tax base. In addition, residential property valuations increased substantially as one-third of the long term workers were assumed to live in single family dwellings which would have an average taxable value almost eight times as great as that of a mobile home. The current net fiscal impact was estimated to be positive throughout the operating period and the cumulative net fiscal balance became positive in year 18. The overall net impact for the entire period of plant construction and operation was positive and equal to about \$9 million. When the cumulative fiscal balance was discounted to present value at 7 percent, the discounted cumulative balance became positive in year 27 and the discounted cumulative balance at the end of the operation period was \$0.7 million.

Summary. The net fiscal impact for state government was positive and quite substantial. The net impact for local government over the plant's assumed life of 30 years also was positive. However, the timing of revenues

and costs is very important to local government as substantial negative impacts occur during plant construction. Transfer payments from state or federal government or a prepayment of taxes by the gasification company are possible means for easing these short-run burdens on local government.

The results of the analysis imply the need for an active program of monitoring and growth management. Because construction of a coal gasification facility requires a large work force, the affected communities will face challenges in meeting rapidly growing needs for public services. Impacted communities planning to meet these needs must consider not only the short-term needs of the construction work force, but also the longer-term needs of the permanent operating work force. In some cases, temporary facilities (e.g., mobile classrooms) may be the best answers. In other situations, the community may wish to consider multipurpose facilities, such as a building which could be used for classrooms during the plant construction period and as a recreation center for construction. State and federal agencies should be prepared to provide timely technical assistance to impacted communities and, in some cases, financial assistance may be required as well.

The model presented in this paper was developed especially for ex ante evaluation of the net fiscal impact of industry in rural areas. However, the model could be adapted for use in evaluating the potential fiscal impact of new industry under a wide variety of circumstances. The primary changes which would be needed would be the incorporation of input-output coefficients appropriate to the area where the industry will locate and revision of the tax estimators to reflect the tax laws and policies of the state in question. The model also could be further refined, depending on user needs, by separating local government into its various components: school districts, municipal government, and county government. The effect of intergovernmental transfer payments on the net fiscal impact for local governments is another topic which deserves further investigation. Finally, additional investigation of factors affecting the incremental costs of providing various public services could contribute to increased accuracy of model outputs.

REFERENCES

1. Belter, W. R., County Government Costs in North Dakota. Unpublished M.S. Thesis, Department of Agricultural Economics, North Dakota State University, 1970.
2. Crowley, R. W., "An Empirical Investigation of Some Local Public Costs of In-Migration to Cities," The Journal of Human Resources, 5:1 (1970), 11-23.
3. Bureau of the Census, State Government Finances in 1972, Washington: U. S. Government Printing Office, 1973.
4. Dalsted, N. L., and F. L. Leistritz. "North Dakota Coal Resources and Development Potential," North Dakota Farm Research, 3:16 (1974), 3-11.
5. Dalsted, N. L., et al. "Economic Impact of Alternative Energy Development Patterns in North Dakota," report prepared for Northern Great Plains Resources Program, North Dakota State University, 1974.
6. Dorgan, B. L., "Interim Annual Report of the Tax Commissioner of the State of North Dakota to the Governor and Legislature for the One-Year Period July 1, 1972 to June 30, 1973," Office of the Tax Commissioner, 1973.
7. Garrison, C. B. "The Impact of New Industry on Local Government Finances in Five Small Towns in Kentucky," U. S. Department of Agriculture, Agricultural Economics Report No. 191, 1970.
8. Gilmore, J. S., and M. K. Duff. "The Sweetwater County Boom: A Challenge to Growth Management," University of Denver Research Institute, 1974.
9. Hirsch, W. Z., "Fiscal Impact of Industrialization on Local Schools," Review of Economics and Statistics, 46 (1964), 191-199.
10. Hirsch, W. Z., "Regional Fiscal Impact of Local Industrial Development," Papers and Proceedings of the Regional Science Association, 7 (1961), 119-130.
11. International City Management Association, The Municipal Yearbook, 1973, Washington, D. C., 1973.
12. Kee, W. S., "Industrial Development and Its Impact on Local Finance," Quarterly Review of Economics and Business, 8:3 (1968), 19-24.
13. Leholm, Arlen G., et al. "Local Impacts of Energy Resources Development in the Northern Great Plains," Report prepared for Northern Great Plains Resources Program, North Dakota State University, 1974.
14. Loewenstein, L. K., "The Impact of New Industry on the Fiscal Revenues and Expenditures of Suburban Communities," National Tax Journal, XVI:2 (1963), 113-129.

15. Michigan-Wisconsin Pipeline Company, Looking Ahead: North Dakota Considers Coal Gasification, 1974.
16. North Dakota State Highway Department, "North Dakota Highway Statistics, 1973," Planning and Research Division, 1973.
17. Northern Great Plains Resources Program, Northern Great Plains Resources Interim Report, Denver, Colorado, 1974.
18. Peterson, M. F., "Forty-second Biennial Report of the Superintendent of Public Instruction for the Period Ending June 30, 1972," Department of Public Instruction, Bismarck, North Dakota, 1972.
19. Prestgard, P. G., "Effect of Coal Development on Public Costs and Revenues in North Dakota," Department of Agricultural Economics, North Dakota State University, Unpublished M. S. thesis, 1974.
20. Sand, L. D. "Analysis of Effects of Income Change on Intersectoral and Intercommunity Structure," Department of Agricultural Economics, North Dakota State University, Unpublished M. S. thesis, 1966.
21. Senechal, D. M., "Analysis of Validity of North Dakota Input-Output Models," Department of Agricultural Economics, North Dakota State University, Unpublished M. S. thesis, 1971.
22. Smith, C. L., T. C. Hogg and M. J. Regan. "Economic Development: Panacea or Perplexity for Rural Areas," Rural Sociology, 36:2 (1971), 173-186.
23. Social Service Board, "Social Services in North Dakota," First Annual Report of the Social Service Board of North Dakota for the Period Ending June 30, 1973, Bismarck, North Dakota, 1973.
24. Youde, James, and Gerald Huettig. "Economic Impacts of a Proposed Beef Packing Plant on the Development of a Rural Central Oregon Community," Western Agricultural Economics Association annual meeting (1971), 157-160.