

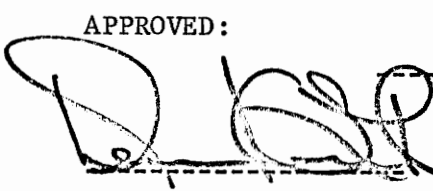
AN ECONOMIC ANALYSIS AND EVALUATION OF THE
IMPACT OF THE CONSTRUCTION AND OPERATION
OF A HYDROELECTRIC FACILITY IN A
RURAL AREA OF VIRGINIA

by

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CHAPTER I

INTRODUCTION

The Virginia Electric and Power Company (VEPCO) has applied to the Federal Power Commission (FPC) for a license to construct a pump-storage hydroelectric generating facility in Bath County, Virginia. This facility would be used to meet peak-load demands for electricity by using surplus generating capacity in VEPCO's system during periods of low demand to pump water from the lower to the higher of two reservoirs. This water would then be allowed to flow back to the lower reservoir to generate electricity during periods of peak demand. Electric utilities contend that this method of dealing with varying demands for electric power over time is less costly than other alternatives.

The construction of the proposed VEPCO facility in Bath County will take approximately six years and will require a labor force of 2400 workers during the peak construction period.^{1/} The phasing of the project is such that the number of construction workers will gradually increase to this peak number and then sharply diminish with about 30 employees required for operation and maintenance of the facility. Bath County and the two counties adjacent to the site of

^{1/} Federal Power Commission, Final Environmental Impact Statement, Bath County Project No. 2716 - Virginia (Washington, D.C.: U.S. Government Printing Office, September, 1975).

the proposed facility; Highland County, Virginia and Pocahontas County, West Virginia are rural in character with a total labor force in these three counties of approximately 5000 workers in 1970.^{2/} Given this rural character of the region, a project of this area will have substantial impacts on the region's economy.

In addition to the hydroelectric generating facility, recreational facilities will be developed adjacent to the pump-storage facility. The expected use of these facilities is of a magnitude that the expenditures of visitors to the region may significantly affect the area's economy. In addition, the large and rapid changes in the number of individuals residing in, and traveling through the region will result in rapidly changing demands for various local government public services.

Problem Statement

The responses of the public and private sectors of the affected region to the above developments is expected to vary. This variation would be in the extent to which these sectors attempted to avoid the costs that are associated with dynamic situations entailing a great deal of uncertainty as to the future.^{3/} An example

^{2/}U.S. Bureau of the Census, U.S. Department of Commerce, County and City Data Book 1972, (Washington, D.C.: U.S. Government Printing Office, 1972).

^{3/}Thomas C. Hogg and Courtland L. Smith, Socio-Cultural Impacts of Water Resource Development in the Santiam River Basin, Water Resources Research Institute Publication WRRRI-5, (Corvallis, Oregon: Oregon State University, October, 1970).

of the costs which may result from a poor perception of the economic future of an area are those incurred by retail sector firms which make investment decisions concerning the expansion of facilities based upon an assumption that current sales levels or rates of change of sales levels are accurate predictors of future sales levels. The use of such predictors could result in an over-expansion of local retail capacities, i.e., an expansion which would not have taken place had information regarding future demands been known. Conversely, a failure of local business to expand sufficiently to meet an increase in local demand could result in losses for local business and costs to the users and potential users of the services of the retail sector reflected in increased prices (including a deterioration in quality) and increased transportation costs necessary in order to obtain the services at more distant locations.

The public sector faces similar problems in making the adjustment required in a rapidly changing situation. A potential problem exists in anticipating the flow of tax revenues for purposes of estimating the constraints upon local government expenditures in future time periods. For example, if a local government did not take into account the increased demands for its services, which would be a likely result of the project, it is quite possible that budgetary inflexibility would cause the quantity or quality of local government services to decline below desirable levels, i.e., those levels which would be attained if the demands for, and the revenue sources

necessary to finance such services were known in advance and the adjustments necessary to attain desired public service levels were made.

Most of the potential problems exist because of the transitory nature of the project's construction phase. A large construction labor force will stimulate local area economic activities through their respending effect. After the project's construction phase, the facility will employ a considerably smaller operating and maintenance labor force. The area's economy will be faced with a downward adjustment problem after the construction phase of the project, especially if there existed an over-estimation of future economic activity. This will entail costs to the area's economic activities because of their inaccurate perception of the future.

The issues raised by the proposed facility in Bath County are nationally relevant. There are many other technically feasible sites for facilities of this type and the majority of these sites are in rural areas. The decision of the FPC on the license application to construct such facilities is dependent upon an assessment of the economic effects of the facility upon the surrounding area and the feelings of area residents.

The provision of information concerning those economic effects both to the FPC and area residents appears necessary to aid in the decision-making process regarding the license application. While there is an effort by the FPC to determine the impact of the proposed facility on the region, it is felt that a more complete and accurate assessment is possible at a cost which warrants its attainment.

Purpose and Objectives of the Study

The purpose of this study is to analyze the economic impacts of the proposed pump-storage hydroelectric generating facility in Bath County on the Bath-Highland-Pocahontas Counties regional economy. The results of this analysis should help provide information and guidelines to improve the decision-making process in terms of present and potential proposals to construct similar facilities in other rural areas. The specific objectives of this study are:

1. To estimate the impact over time of the proposed hydroelectric generating facility upon the level of economic activity and local government revenues and expenditures of Bath, Highland and Pocahontas Counties.
2. To estimate the local benefits and costs associated with the proposed recreational facilities and to evaluate the justification for the inclusion of such recreational facilities in hydroelectric facilities.
3. To evaluate the procedures used by the FPC in considering license applications for hydroelectric facilities.

Contents of the Study

In Chapter II, the methods of analysis that will be employed in the study are discussed and previous analytical efforts to predict the impact of similar types of changes in economic conditions are reviewed to form a conceptual basis for this study. The estimation of the impact of the proposed facility on the study area's economy is made in Chapter III through the use of input-output analysis methodology. In addition, estimates are made of the impact of the economic changes in the region on local government revenues and expenditures. In Chapter IV, the economic and legal justifications for the inclusion of the recreational facilities benefit and cost estimates in

the total project estimates are critically examined from both a regional and a national perspective. In Chapter V, the summary and conclusions of the study are presented. These conclusions will be generalized in terms of the consideration of proposals to locate such projects in other rural areas and in terms of FPC licensing procedures.

CHAPTER II

METHODOLOGY AND CONCEPTUAL FRAMEWORK

Introduction

In this chapter, the methodology that will be utilized in this study to estimate the economic impacts of the VEPCO project will be presented and discussed. This involves the review of the three areas of input-output analyses, local government budgeting, and benefit-cost analysis. These reviews will be made in terms of previous analytical efforts to assess the impacts of similar types of changes on regional economics.

Input-Output Analysis

Input-Output (I-O) analysis is based on the determination of the interrelationships among the elements of an economic system.^{1/} The initial step in performing an I-O analysis is the classification of the various units of the study economy (economics can range in size from small towns to entire counties) into sectors. Several different criteria can be used to aggregate the units of an economy into sectors. The criterion most commonly employed is that of simi-

^{1/}Two basic I-O analysis text books are: William H. Miernyk, The Elements of Input-Output Analysis (New York: Random House, 1965); and Hollis B. Chenery and Paul G. Clark, Interindustry Economics (New York: John Wiley & Sons, Inc., 1959).

larity of product type. The process of determining I-O sectors for a study economy depends upon the availability of data and purposes of the analysis. For example, all retail and wholesale activity can be considered as a single sector or grocery stores, hardware stores, gas stations, etc., could be considered as separate sectors.

Regardless of the extent to which an economy is divided, the sectors will fall into five categories:^{2/}

"Intermediate" -- private business activities within the study region which are broken down into individual activities. Much of the detail of the I-O analysis refers to the transactions among these activities.

"Households" -- individuals and families residing in the study region considered both as buyers of consumer goods and as sellers -- primarily of their own labor.

"Government" -- local and in some cases state and national public authorities.

"Exogeneous" -- private and public economic activities located outside the region.

"Capital" -- the stock of private capital, both within and outside the region, including both fixed capital and inventories.

After the economy is divided into sectors, the purchases and sales patterns of each sector are determined in terms of the sectors to and from which those sales and purchases are made. This sales and purchase information is shown in tabular form in a "transactions matrix." A transactions matrix consists of the sectors of an economy arrayed horizontally and vertically in identical order. A hypothetical nine sector transactions matrix is shown in Table 1.

^{2/}Adapted from: Edgar M. Hoover, An Introduction to Regional Economics (New York: Alfred A. Knopf, Inc., 1971), p. 225.

Table 1. Hypothetical Input-Output Model Transactions Matrix (thousands of dollars)^{a/}

Inputs	Agriculture	Manufacturing	Transportation	Wholesale & Retail	Services	Households	Exports	Investment	Government	Total Sales
Agriculture	34	290	0	0	0	7	137	0	1	469
Manufacturing	25	1134	5	13	188	607	12303	27	10	14312
Transportation	6	304	54	25	80	22	111	5	3	610
Wholesale & Retail	13	490	18	45	156	1171	723	29	11	2656
Services	35	472	53	258	418	1387	816	573	229	4241
Households	208	3242	252	881	1816	869	1203	0	244	8715
Imports	77	5712	83	456	892	2539				
Depreciation	24	2157	129	805	446	489				
Government	47	511	16	173	245	1624				
Total Purchases	469	14312	610	2656	4241	8715				

^{a/} Adapted from: James E. Pratt and Dennis K. Smith, "Input-Output Analysis: An Introductory Self-Learning Package," Staff Working Paper, Department of Agricultural Economics, Virginia Polytechnic Institute and State University, Blacksburg, Virginia, May, 1976.

An entry in the transactions matrix shows the value of goods or services provided by a sector to another and equivalently the amount of money paid to a sector by another. The distribution of the total sales (output) of the sectors are read across the rows of the matrix. The distribution of sector purchases (inputs) are read down the columns of the matrix. For example, the entry of 25 at the intersection of the Manufacturing row and Agriculture column indicates that the Manufacturing sector sells \$25,000 worth of output to the Agriculture sector and that the Agriculture sector purchases \$25,000 worth of inputs from the Manufacturing sector.

The sum of entries in the row (total sales) corresponding to a given sector and the sum of the entries in the column (total purchases) corresponding to that sector will be equal for the "intermediate" or processing sectors. This equality holds true in aggregate, but not for the individual sectors in the "payments sectors" (Imports, Depreciation, and Government) and in the "final demand sectors" (Exports, Investment, and Government).

The estimation of transactions matrices for regional economics can be conducted by two principal methods. Surveys of the firms, individuals and institutions comprising the sectors can be made to determine the total level of sales and purchases and the sectors to and from which those sales and purchases are made.^{3/} An alternative is to use transactions matrices for other areas of analysis to deter-

^{3/}H. B. Gamble and D. L. Raphael, A Microregional Analysis of Clinton County, Maine, II The Pennsylvania Regional Analysis Group, (University Park: The Pennsylvania State University, 1966).

mine the regional flow of goods and services.^{4/} The "direct requirements coefficients" of the two areas for the same sectors are assumed to be identical. Total sales for the various sectors are generally available from secondary sources and thus if direct requirements coefficients are assumed to be equal in the two areas, a transactions matrix can be estimated. One method employed in such a procedure is to use coefficients derived from the national input-output table. This is questionable because the sectors of a region are not expected to purchase the same proportion of their inputs from within the area of analysis as are the sectors of the nation.

The method employed in this study was to use a transactions matrix, derived by survey techniques, for an adjacent three county area in West Virginia to estimate the transactions matrix for the three county area of analysis.^{5/} It was determined that these areas were quite similar in many respects and it was assumed that the direct requirements coefficients found to occur in these areas would be quite similar.

A transactions matrix can be used to derive a "direct requirements" matrix which shows the values of goods and services purchased from the various sectors by a particular sector for each dollar of

^{4/} W. H. Miernyk, op. cit. and F. T. Moore and J. W. Peterson, "Regional Analysis: An Interindustry Model of Utah," The Review of Economics and Statistics, XXXVII, 4 (November, 1955), 368-381.

^{5/} N. L. Bills and A. L. Barr, An Input-Output Analysis of the Upper South Branch Valley of West Virginia, Agricultural Experiment Station, (Morgantown: West Virginia University, June, 1968).

total sales by that sector. The direct requirements matrix for the hypothetical transactions matrix shown in Table 1 is presented in Table 2. For example, the total output or sales of the agriculture sector are \$469,000 and the agricultural sector purchased \$25,000 worth of goods from the manufacturing sector; then the direct requirements coefficient relating output of agriculture and sales of manufacturing is .053.

The direct requirements matrix shows the purchase made by a sector for each dollar of sales by that sector, but it does not show the total amount of sales required by each sector for a dollar worth of sales by a particular sector. This is the case because a sector making sales to a particular sector may also be called upon to make sales to other sectors if those sectors are to make sales to the particular sector. Those sales in turn require further sales -- the "multiplier effect."

The total sales necessary by the various sectors for each dollar of sales by particular sectors are shown in an "interdependency coefficients" matrix which is analogous to the direct requirements matrix, but which shows the total sales of a sector required in order for another sector to produce a dollars worth of output. The interdependency coefficients matrix for the hypothetical transactions matrix is shown in Table 3.

A transactions matrix and the direct requirements and interdependency matrices derivable from it provide useful insights into the functioning of an economy. One of the most common purposes of input-output analysis is "impact analysis." Impact analysis is con-

Table 2. Hypothetical Input-Output Model Direct Requirements Matrix^{a/}

	Agriculture	Manufacturing	Transportation	Wholesale & Retail	Services	Households
Agriculture	.073	.020	.000	.000	.000	.001
Manufacturing	.053	.079	.008	.005	.044	.070
Transportation	.013	.021	.089	.009	.019	.003
Wholesale & Retail	.028	.034	.030	.017	.037	.134
Services	.075	.033	.087	.097	.099	.159
Households	.443	.227	.413	.332	.428	.100
Imports	.164	.399	.136	.172	.210	.291
Depreciation	.051	.151	.211	.303	.105	.056
Government	.100	.036	.026	.065	.058	.186
Total	1.000	1.000	1.000	1.000	1.000	1.000

^{a/} Adapted from: James E. Pratt and Dennis K. Smith, "Input-Output Analysis: An Introductory Self-Learning Package," Staff Working Paper, Department of Agricultural Economics, Virginia Polytechnic Institute and State University, Blacksburg, Va., May, 1976.

Table 3. Hypothetical Input-Output Model Interdependency Coefficient Matrix.^{a/}

	Agriculture	Manufacturing	Transportation	Wholesale & Ret.	Services	Households
Agriculture	1.082	.025	.002	.002	.003	.004
Manufacturing	.132	1.126	.076	.057	.114	.116
Transportation	.027	.031	1.107	.019	.032	.014
Wholesale & Retail	.148	.102	.141	1.101	.147	.199
Services	.245	.129	.248	.216	1.256	.265
Households	.749	.409	.698	.532	.697	1.347
Total	2.383	1.822	2.272	1.927	2.249	1.945

^{a/}Adapted from: James E. Pratt and Dennis K. Smith, "Input-Output Analysis: An Introductory Self-Learning Package," Staff Working Paper, Department of Agricultural Economics, Virginia Polytechnic Institute and State University, Blacksburg, Va., May, 1976.

ducted in order to determine the effect of a change in the demand(s) for the product(s) of the various sectors of an economy. If, for example, it is expected that the demands for retail and wholesale sales to individuals not part of the local economy will increase by \$1,000,000; impact analysis can be performed in order to determine the sales changes resulting in each sector and the sum of the sales changes in the economy. The interdependency matrix provides the information necessary for an impact analysis as the total sales necessary by a sector to support a dollars worth of sales in another sector are multiplied by the expected change in the sales of the latter sector to obtain the total expected change in the sector.

The derivation of the direct requirements and interdependency matrices and the procedure of impact analysis are based upon the assumption that if a sector changes its level of sales, it will change its purchase of inputs in the same proportion. The relationships between input and output found to exist in the time at which a transactions matrix is derived are thus assumed to hold as changes take place in the level of sales.

It is also assumed that the sectors of the economy can increase their sales to meet whatever demands are made of them. This latter assumption is reasonable in cases in which the expected changes in sales by the sectors is a relatively small portion of the total sales of that sector. In the analysis conducted, however, this was not the case in all sectors as it was discovered that the demands for labor, as indicated by the demands for sales by the household sector, exceeded the available pool of unemployed and

underemployed individuals. The estimates of the total sales by the household sector of the region and the other sectors would be too high if derived by the usual impact analysis because the estimates would include the sales generated by the expenditures of households which would not in actuality take place. To circumvent this problem a two-part model was developed which permitted the sectors of the regional economy to purchase labor from households of the region up to that point at which it was estimated that the local labor supply would be exhausted. Additional demands for the outputs of various sectors would remain at this point. It was assumed that these remaining demands would be met, but that the labor necessary to permit the production of the increased output would be supplied from outside the region by individuals commuting into the region. It may be assumed that commuters would not spend a significant portion of their income locally. Thus, the payments to labor which would normally accrue to local households were assumed to go outside the region with no respending of those payments once the labor force was exhausted. Estimates of the sales of the various sectors will be less when the two-part model is employed because there is a reduction in local purchases resulting from the expenditure of payrolls.

Benefit-Cost Analysis

Benefit-cost (B/C) analysis is a procedure for assessing the desirability of projects of a public nature.^{6/} B/C analysis essentially involves the estimation of the costs of a project and the benefits in terms of a common unit of value, the adjustment of those costs and benefits according to the time at which they are incurred, and the comparison of benefits and costs as expressed by the ratio of benefits to costs. B/C analysis is analogous to the investment decision procedures used in the private sector.

The estimation of the costs of a project is not generally difficult as the costs of construction can be estimated from the relevant engineering data. It is assumed that the prices of the items used in the construction and operation and maintenance of a project reflect their "true cost." It is implicitly assumed, for example, that the pollution which may be associated with the production of certain items used in the construction of a project is not significant.

The estimation of benefits of public projects cannot generally be made with the same degree of confidence. This is the case because the benefits of public projects are not usually items upon which prices are attached.

^{6/}A general survey of B/C analysis is found in: A. R. Prest and R. Turvey, "Cost-Benefit Analysis: A Survey," The Economic Journal, Vol. 75, No. 300 (December, 1965), pp. 683-705. A detailed explanation of the procedures of B/C analysis as practiced by federal agencies in evaluating water resources projects is found in: Water Resources Council, "Water and Related Land Resources - Establishment of Principles and Standards for Planning," Federal Register, Vol. 38, No. 174, Part III (September, 1973).

The benefits of the VEPCO project recreational facilities will be realized through the use of the recreational facilities. Estimates of the use of the facilities are available as are generally accepted estimates of the range of the dollar value of the use of such facilities by an individual for one day. A range of benefit estimates can thus be determined.

Benefits and costs occurring in future time periods must be discounted just as the costs and revenues of a private investment project are discounted. All federal agencies apply standard discount rates to all projects which are analyzed.

B/C analysis provides a measure of the effect of a project on net welfare as measured by the prices attached to the resources consumed by, and the uses made of, the project. It does not take into account who receives the benefits and who bears the costs of a project -- distributional questions. B/C analysis can be conducted to determine the effect on the net welfare of a region or upon the entire nation. There is frequently a considerable difference in the effects as the costs and benefits often occur outside the region.

Local Government Budgeting

The prediction of the effect of the VEPCO project on the expenditures and revenues of the governments of the area depends upon

certain assumptions.^{7/} It was assumed that the quality of services provided by the local governments in the area would remain constant over the period in which changes in the total level of services demanded are expected. If this assumption is made, the present expenditures of the local governments to provide a particular service to a given number of people can serve as predictors of the expenditures necessary to provide certain services to an increasing number of individuals.

The accuracy of estimates of the effect of the VEPCO project on the revenues of local governments depends largely upon the accuracy of the predictions of the population changes resulting from the project. Given population levels, the estimation of revenues can be conducted with relative confidence as the major portion of revenues which are expected to be affected by population changes are state funds distributed according to school age population according to formulas. The revenues, not directly tied to population which are expected to be affected, are personal property tax revenues and the fraction of the sales tax collected in the county returned to the county by the state. The former can be estimated by analyzing current property taxation procedures and assuming that those prac-

^{7/}An example of local government budgeting at the county level is: B. F. Long and J. P. Marshall, "The Impact of a Construction Worker Community on a Rural County: A Case Study," Evaluating Impacts of Economic Growth Proposals, Northeast Regional Center for Rural Development, Publication 8, (Ithaca, New York: Cornell University, April, 1975). A general framework for such analysis is provided by: Frank Goode, "A Framework for Analyzing the Fiscal Impact of Economic Development on a Community," Evaluating Impacts of Economic Growth Proposals, Northeast Regional Center for Rural Development, Publication 8, (Ithaca, N.Y.: Cornell University, April, 1975).

tices will continue. The estimates of sales tax revenues depend upon the predictions made of taxable sales during the period of project impact.

Summary

In this chapter, the methodological framework for the study was established through a review of input-output analysis, benefit-cost analysis, and local government budgeting. Variations on these techniques were presented and discussed in terms of how they apply to the analysis of the impact on a rural region's economy of the proposed hydroelectric facility project being examined.

CHAPTER III

ANALYSIS OF THE REGIONAL ECONOMIC IMPACT OF THE PROPOSED HYDROELECTRIC FACILITY

Introduction

The major impact of the VEPCO project on the Bath, Highland, and Pocahontas Counties (BHP) economy will result from the local expenditure of the wage payments made to workers employed in construction of the facility. While there may be some local purchases of non-labor inputs in the construction process, it would appear unlikely that such purchases would be of a significant magnitude relative to the local expenditures for labor. Major expenditures on earth moving machinery, fuel, electrical equipment and miscellaneous construction supplies are not expected to occur in the BHP region as these items are locally available or are not available in the required quantities. Gravel and other fill material will be obtained from sites in the BHP region, but these sites will be owned by VEPCO and operations conducted by a contractor from outside the area.^{1/}

In addition to the short-run major impact of the project's construction phase which will take about six years, the facility's operating and maintenance labor force and the recreational facilities

^{1/} Federal Power Commission, Final Environmental Impact Statement - Bath County Project No. 2716 - Virginia (Washington, D.C.: U.S. Government Printing Office, September, 1975).

to be developed as part of the project will impart long-run impacts of a lesser magnitude. The impacts of these latter two factors will be examined together with the construction labor expenditure impact.

The effect of a given expenditure on labor upon the sales levels of the various sectors of the BHP economy depends principally upon the consumption patterns of the workers and the extent to which the expenditures of the workers are in turn respent locally by the various sectors. An input-output (I-O) transactions matrix was estimated for the BHP region in order that the impact on sales levels of the respending could be determined.

Development of the BHP Region's
I-O Transactions Matrix

Resource limitations did not permit the construction of a transactions matrix for the BHP region through the use of sample survey techniques. An I-O transactions matrix had previously been estimated for an adjacent three county region in West Virginia.^{2/} The two regions were compared to determine if their economies were sufficiently similar to permit the use of the model of the Upper South Branch Valley (USBV) region of West Virginia in estimating an I-O transactions matrix for the BHP region.

The populations of the USBV at the time of the study of that region and of the BHP region in 1970 were found to be similar in size and type. The population of the USBV was estimated to be 23,000

^{2/} Nelson L. Bills and Alfred L. Barr, An Input-Output Analysis of the Upper South Branch Valley of West Virginia (Morgantown, West Virginia: Agricultural Experiment Station, West Virginia University, June, 1968).

in 1956 while that of BHP was 16,429 in 1970. Population densities of the regions were 13.1 and 8.6 for the USBV in 1965 and the BHP in 1970, respectively. Both regions had per capita money incomes well below the state averages. Both experienced net out-migration and a decline in total population between 1960 and 1970. Both regions had an average education level below the state averages and both had a median age above state averages. The employment levels of the sectors common to both regions are similar as are the relative levels between those sectors. The levels of these economic and demographic measures are shown in Table 4.

In using the transactions matrix of the USBV region to construct a transactions matrix for the BHP region, it was assumed that the sectors of the two regions are similar in the manner in which they produce their output, i.e., that the production of a given value of the output of any sector is accomplished with the same input combination in both regions. It was also assumed that the proportions of the purchases of inputs from within and outside the region are proportionally the same in the two regions. The two sectors which have been found in previous studies to be the most sensitive to changes in total local sales are the retail and wholesale trade sector and the service sector. These two sectors have not been found to vary greatly in their input-output combinations in different regions even when those regions are not as similar as the USBV and BHP re-

Table 4. Comparative Economic and Demographic Characteristics of the Bath-Highland Pocahontas Counties and Upper South Branch Valley Regions^{a/}

Item	BHP Region	USBV Region
1960-70% population change	-9.9%	-5.1%
1970 median age of population	35.5 yrs.	32.1 yrs.
1970 median school years completed, persons 25 years and over	9.2 yrs.	8.8 yrs.
1970 per capita income	\$1847	\$1816
Percent employment distribution by sector: ^{b/}		
Agriculture	13.0%	33.5%
Construction	8.3%	9.9%
Manufacturing	21.4%	18.8%
Wholesale & Retail Trades	12.1%	16.1%
Finance, Insur., & R.E.	1.4%	1.4%
Services	37.3%	16.3%
Local Government	6.5%	4.0%

^{a/} Source: U.S. Bureau of the Census, Census of Population: 1970, General Social and Economic Characteristics (Washington, D.C.: U.S. Government Printing Office, 1972).

^{b/} The employment percent distribution for the BHP region is for the year 1970; whereas for the USBV region it is for the year 1960.

gions.^{3/} Differences in the sizes of the sectors between the two regions does not necessarily make questionable the use of the USBV I-O matrix to derive a transactions matrix for the BHP region if the assumptions are realistic.

The USBV study divided the local economy into 15 sectors. Fourteen of these sectors were found to be present in the BHP region and output levels (i.e., value of sales) of these sectors for 1974, computed at June, 1974 price levels, were estimated.^{4/} Price level indice data are not available. This entails an implicit assumption that changes in United States and regional price levels are correlated to the extent that the use of the national indices does not introduce significant error into the regional analysis.

The value of the BHP region's agricultural sector's (Standard Industrial Classification (SIC) code 0110-0729) sales was estimated by adjusting the most recent available sales figures (1969) by a weighted price level index.^{5/} In estimating the sales level of the

^{3/} Hays, B. Gamble, William M. Swope and Janet H. Glass, The Regional Economy of Potter County Pittsylvania, The Institute for Research on Land and Water Resources, Publication No. 64, (University Park, Pa.: The Pennsylvania State University, July, 1970) and R. D. Pepper and H. A. Clonts, The Economy of Talladega County, Alabama, Agricultural Experiment Station Bulletin 453 (Auburn, Ala.: Auburn University, January, 1974).

^{4/} Council of Economic Advisors, Economic Report of the President, (Washington, D.C.: U.S. Government Printing Office, 1972).

^{5/} United States Bureau of the Census, Census of Agriculture, 1969 (Washington, D.C.: U.S. Government Printing Office, 1972).

agricultural sector in this manner, it is assumed that the value of agricultural sales remained constant in the period 1969 to 1974 with changes in price levels taken into account. In addition, this assumption was made in estimating the sales levels of the other sectors in the model. These assumptions were based on the relative stability of sales levels of the sectors of the BHP economy and because of the lack of sufficient data to accurately estimate trends in the sales levels of the various sectors.

Contract Construction (SIC code 1510-1799) sales levels were estimated by multiplying the 1970 total wage bill of construction contractors in the three county study area by the ratio of sales level to wage bill found in the USBV region.^{6/} This figure was then adjusted for June, 1974 price levels and for the increase in construction activity in the area in the interval.

Food Manufacturing (SIC code 2010-2099) sales levels were estimated by a similar procedure. An estimated annual wage bill was calculated with the use of 1972 employment levels and the average annual income level for manufacturing in the region during 1974. This wage bill was then multiplied by the sales level/wage bill ratio of the USBV economy.

There are two, fairly sizable apparel manufacturing firms in the BHP region. These firms make no local sales and are therefore assumed to be unaffected by any increase in local expenditures. This

^{6/} United States Bureau of the Census, U.S. Census of Population: 1970, General Social and Economic Characteristics (Washington, D.C.: U.S. Government Printing Office, 1972).

sector was omitted from the transactions matrix of the local economy as the purpose of the I-O analysis will be to determine the impact of an increase in local expenditures.

The "Other Manufacturing" sector (SIC code 2710-2799, 3110-3199 and 3210-3299)^{7/} and the Transportation sector (SIC code 4010-4789) sales levels were estimated in an analagous fashion to the other sectors discussed above.

The Communications and Utility sector (SIC code 4810-4971) is not a local or endogenous sector in that there is no significant local provision of the services of this sector by a local communications and utility firm. There will be no local respending caused by increased purchases from this sector and it was omitted from the transactions matrix.

The Retail and Wholesale Trade sector (SIC code 5070-5999) sales level for 1974 was estimated by adjusting the 1972 sales levels of the retail sectors of Bath, Highland and Pocahontas Counties by June, 1974 price levels. The wholesale trade sales were estimated by adding the adjusted wholesale sales of Pocahontas County to estimates of the wholesale sales of Bath and Highland Counties derived through the use of an estimated wage bill and the wage/sales ratio of the USBV region.

The sales of the Commercial Banking sector (SIC code 6020-6028) consist primarily of the interest charges for loans by the

^{7/}The "Other Manufacturing" sector includes firms in the: Printing, Publishing and Allied Industries; Leather and Leather Products; and Stone, Clay, Glass and Concrete Products categories.

banks to local residents and the return from the purchase of various money market instruments. Total deposits of banks in the BHP region were estimated by adjusting the most recently available figures for June, 1974 price levels. Total sales were then estimated by determining the approximate portion of deposits lent to individuals and multiplying them by the relevant interest rates and adding to this the product of the remaining deposits and the average rate of return from money market instruments.

The Other Finance, Insurance and Real Estate sector (SIC code 6110-6799) sales level was estimated by assuming that the ratio of the above sector's sales to those of the commercial banking sector was the same in the BHP region as in the USBV region.

The Service sector (SIC code 7010-8999) sales level was estimated by multiplying total service sector employment by the average service sector wage in the three county area to obtain the total wage bill and then applying the USBV wage/sales ratio for the Service sector to obtain estimated total sales. The Service sector's estimated sales level does not include the substantial sales by the Homestead Resort. The Homestead Resort does not have significant sales to local residents and its sales level will thus be relatively unaffected by any increase in local expenditures by individuals engaged in the project construction. Other motels and hotels located in the region were included in the BHP Service sector and their relative importance in the Service sectors of the two regions was approximately equal.

The sales of the Local Government sector (SIC code 9301-9390 and 8211), i.e., local government revenues, were estimated by adjusting the most recent figures for Bath and Highland Counties for June, 1974 price levels. Tax revenues for Pocahontas County were estimated by assuming that local government revenues were in the same ratio to population in Pocahontas County as in Bath and Highland Counties. Tax revenue figures for 1967 indicate that this assumption is not unreasonable.^{8/}

The sales of the Household sector (i.e., personal income) were estimated by adjusting the most recent available income figures for the three counties for June, 1974 price levels.^{9/}

The above estimates of sector sales are assumed to be reasonably accurate. However, it is important to note that the accuracy of the estimates of absolute changes in sales levels made in the analysis that follows are not dependent upon the accuracy of the sector sales estimates. This accuracy depends upon the extent to which the transactions matrix derived accurately depicts the level of input purchases necessary to produce a given quantity of output.

The transactions matrix of the BHP region was estimated based on the assumption that the sectors of the BHP were identical to the same sectors of the USBV in their mixes of values of purchases from each of the other sectors for a given total sales value. That is,

^{8/} United States Bureau of the Census, *County and City Data Book, 1972: A Statistical Supplement* (Washington, D.C.: U.S. Government Printing Office, 1972).

^{9/} Ibid.

the individual elements of the BHP region's transactions matrix, except the final demand vector, were estimated by multiplying the ratio in the USBV transactions matrix of the sales of a particular sector to another sector to the total sales of the latter sector by the estimated total sales in BHP.

The two part (Capital Formation and Exports) final demand vector was estimated by assuming that each of the two parts were, for a given sector, the same proportion of total sales of that sector in the BHP as was found to be the case in the USBV.

When a transactions matrix is estimated in the above manner, the matrix obtained will not be consistent (i.e., row and column totals for a given sector will not be equal) if the sectoral total sales levels of the estimated matrix are not in the same proportion to each other as the sectoral total sales levels of the original model are to each other. In order to make the BHP transactions matrix consistent, adjustments were made in estimated exports of the various sectors so that the appropriate row and column identities held.^{10/}

^{10/} In the Food Manufacturing sector, the estimation of the transactions matrix in the above manner led to results at variance with the predictions of the sales levels of the BHP as the sum of the row entries of that sector (excluding the final demand entries) exceeded the predicted sales level of that sector. The Food Manufacturing row entries were estimated by assuming that sales to the various sectors in the BHP were in the same proportion of total food manufacturing sales as was the case in the USBV. The requirements of the various sectors for the output of the Food Manufacturing sector that exceeded these row entries were assumed to be met by the exogenous sector. The difference between the row entries derived by the same method employed in estimating the other sectors and the row entries estimated by the above method was thus added to the appropriate exogenous entry.

An example of the estimation of an element of the BHP transactions matrix is shown below in terms of the Service sector sales to the Agricultural sector:

\$ 154,600 - USBV service sector sales to agriculture

19,218,500 - USBV total agricultural sales

9,823,000 - BHP estimated agricultural total sales

$$\frac{154,600}{1,921,800} \times \$9,823,000 = \$79,000 - \text{BHP service sector sales to agriculture}$$

The BHP transactions matrix is shown in Table 5.

Distribution of Project Construction
Labor Expenditures

The impact of the expenditures from the construction project payroll on the local sectoral sales levels will be estimated by considering increased local expenditures as increases in final demand. A different final demand vector for each of the nine years of the construction phase of the project will be estimated based on the changing composition and consumption patterns of the project labor force.

The construction labor force can be divided into three categories for the purpose of estimating local expenditures of the project payroll: (1) those individuals residing in the area before the start of the project, (2) those individuals who move to the region during their employment at the project, and (3) those individuals who commute to the project from outside the BHP region.

It was assumed that workers in the first category will allocate their income to the various sectors of the BHP economy in the

Table 5. Transactions Matrix for the Bath-Highland-Pocahontas Counties Region, 1974 (thous. \$)

	Agr.	Constr.	Food Mfg.	Wood Mfg.	Other Mfg.	Transpt.	W&R Tr.
Agr.	389.0	0	79.6	81.3	0	1.0	0
Construc.	39.5	33.6	0	0	0	0	248.2
Food Mfg.	209.0	0	.8	5.0	0	2.5	14.9
Wood Mfg.	49.6	20.3	0	0	0	0	0
Other Mfg.	4.3	22.5	.8	0	0	1.0	229.0
Transpt.	22.6	5.6	0	7.6	10.2	0	381.0
W&R Trd.	426.0	54.5	1.6	14.0	31.5	42.5	3,098.0
Banking	65.3	14.1	.3	7.5	12.5	15.4	220.0
Other FI & RE	15.7	3.2	0	2.1	1.6	2.2	81.0
Services	79.0	12.1	.4	19.1	31.5	14.5	138.0
Local Gov't	100.4	1.2	2.1	2.4	18.3	2.1	221.0
Households	1606.0	1247.0	60.8	1546.0	1317.0	557.0	12,387.0
Exogeneous	6816.0	4586.0	553.0	23.15	3577.0	362.0	6,983.0
Total	9823.0	6000.0	700.0	4000.0	5000.0	1000.0	24,000.0

Table 5. (Continued)

	Banking	Other FI&RE	Services	Local Gov't	House- holds	Final Demand		Total Sales
						CapFor.	Export	
Agr.	0	0	0	0	530.0	0	8,743.0	9,823
Construc.	5.0	0	0	15.5	91.0	5,530.0	37.4	6,000
Food Mfg.	0	0	0	10.9	14.0	0	444.0	700
Wood Mfg.	0	0	0	0	0	14.3	3,916.0	4,000
Other Mfg.	3.4	2.0	3.4	29.9	389.0	348.0	3,967.0	5,000
Transpt.	.2	0	15.8	10.9	43.0	0	503.0	10,000
W&R Trd.	2.4	4.3	119.0	53.8	10,790.0	1,133.0	8,227.0	24,000
Banking	0	2.7	16.9	9.0	399.0	0	228.0	988
Other FI & RE	2.5	0	9.3	3.7	375.0	12.4	31.6	540
Services	16.0	6.4	21.3	123.0	5,270.0	0	1,316.0	7,000
Local Gov't	5.6	5.8	41.1	13.0	950.0	0	2,637.0	4,000
Households	461.0	321.0	4094.0	2978.0	865.0	1,125.0	12,901.0	41,466
Exogeneous	492.0	198.0	2179.0	752.0	21,752.0	40,000.0	10,000.0	50,000
Total	988.0	540.0	7000.0	4000.0	41,466.0			

manner as the Household sector of the USBV. The Household column of the USBV transactions matrix provides a means to estimate the proportions of the income of workers in this first category spent on purchases from the various sectors.

It was assumed that the workers in the second category will spend one-quarter of their income locally. This amount would be spent on purchases from the various sectors in the same proportions as the amount spent locally by individuals in the first category. The one-quarter of income is in contrast to the approximately one-half of income that was found to be spent locally by the residents of the USBV and which was assumed to be spent locally by the permanent residents of BHP.^{11/}

There will be a great deal of variation in the proportion of income spent locally by workers in the second category. The one-fourth local expenditure estimate for these workers is the midpoint of the range of the one-half figure assumed for permanent residents and the zero local expenditure figure assumed for in-commuters. Based on this reasoning, the one-fourth figure used probably represents a accurate estimate of the proportion of aggregated income spent locally by this category of workers.

It has been estimated in another study that 30 percent of the peak labor force will locate in a "Construction Worker Community" built by VEPCO in Highland County. It has been estimated that 47 percent of the labor force will locate in Bath County for the dura-

^{11/}Nelson L. Bills and Alfred L. Barr, op. cit.

tion of employment and that 23 percent of the labor force will be permanent residents of the area within 50 miles of the project site who would commute to the project.^{12/}

It was assumed that the proportion of employees in the above three groups will remain constant as the employment at the project varies over the nine year period, except in the last two years as the proportion of project employees in permanent positions in the operation and maintenance of the facility becomes larger.

Based on an analysis of the demographic characteristics of the region, it is estimated that one-half (11.5 percent) of the 23 percent of the workers expected to commute to the project will be permanent residents of BHP. Local expenditures by in-commuters from outside the BHP region will probably be insignificant in terms of the proportion of their total income. Therefore, for purposes of this analysis, it was assumed that they would have no local expenditures. In addition, the average income of individuals is assumed to be equal in each of the three categories of the labor force.

Based on the above estimates and assumptions, 88.5 percent of the project payroll will accrue to individuals who will have significant local expenditures. Seven-seventy percent (47 percent + 30 percent) will be spent by workers who will move to the region during their employment at the project and 11.5 percent by workers currently residing in the area before the start of the project.

^{12/}J. Paxton Marshall and Burl F. Long, "The Impact of a Construction Worker Community on a Rural County: A Case Study," North-east Regional Center for Rural Development Publication 8, (Ithaca, N.Y.: Cornell University, April, 1975).

The total payroll, the portion of the payroll accruing to permanent residents of BHP and to temporary residents of BHP, and the total increase in local final demand expected in each of the nine project years examined are shown in Table 6. During the first seven years of the project, the total payroll consists entirely of construction wages. In the eighth year, the facility will begin operation while the construction is completed. In the ninth year, construction will be completed and only facility operation and maintenance employee wages will be paid.

The wages of the temporary residents in the eighth year were estimated under the assumption that all operation and maintenance positions would be held by permanent residents while the construction positions would be held by temporary and permanent residents and commuters in the same proportions as were assumed in the previous periods. The operation and maintenance payroll in the eighth year was estimated to be \$375,000 (25 employees at an average annual income of \$15,000). The income of the temporary residents was estimated to be $(2,030,000 - 375,000) \times .77 = \$1,274,000$ (i.e., total payroll minus operation and maintenance payroll times the proportion of construction workers consisting of temporary residents). The wages of the permanent residents during the eighth year were estimated to be $(2,030,000 - 375,000) \times .115 = 190,325 + 375,000 = 565,000$ (i.e., payroll to construction workers times the proportion of construction workers consisting of permanent residents plus the operation and maintenance payroll).

Table 6. Total Project Payroll Accruing to Permanent and Temporary Residents and the Local Increase in Final Demand from Project Payroll Expenditures in the Bath-Highland-Pocahontas Counties Region by Project Year (thous. \$)^{a/}

Project Year	Total Payroll	Temporary Residents	Permanent Residents	Total Local Increase in Final Demand
1	4,604	3,545	529	1,151
2	20,386	15,697	2,344	5,096
3	38,901	29,954	4,474	9,725
4	40,895	31,489	4,703	10,224
5	36,509	28,112	4,199	9,127
6	18,894	14,548	2,173	4,724
7	10,379	7,992	1,194	2,595
8	2,030	1,274	565	601
9	525	-	525	263

^{a/} The data reported are in terms of June, 1974 prices and are derived from: Rod W. Smith, A Study of the Areas of Primary Budget Impact Upon Bath County, Va., VEPCO Pump Storage Project, (Staunton, Va.: Central Shenandoah Planning District Commission, November, 1975).

In the ninth year, all employees of the project will be engaged in permanent operation and maintenance positions and all are assumed to be permanent residents of BHP. Final demand estimates for the ninth year are expected to occur indefinitely in the years following completion of the facility.

The total increases in regional final demands over the levels existing before the start of construction are estimated under the assumption that temporary residents will spend one-quarter of their income locally while permanent residents will spend one-half of their income locally. The total increase in regional final demands were allocated to the various sectors of the BHP economy in the same proportions as income was allocated to the sectors of the USBV economy by residents of the USBV. The increases in final demands of the various sectors for the nine years and the total final demands of the various sectors for the nine years are shown in Table 7 and Table 8, respectively.

Local Impact of Project Labor Expenditures
Without Labor Resource Constraints

In Table 8, the total local final demands by sector for the BHP region are reported. These figures are the sum of pre-project sector sales and the increased sales generated by local expenditures from project wages and salaries. These figures represent only the direct effect of project expenditures and do not include the indirect and induced effects of the increased local expenditures. The I-O model estimated for the BHP region can be used to estimate these latter two effects and express the total sales generated by sector

Table 7. Local Increases in Final Demand by Sector from Project Payroll Expenditures in the Bath-Highland-Pocahontas Counties Region by Project Year (thous. \$)^{a/}

Sector	Project Year								
	1	2	3	4	5	6	7	8	9
Agriculture	31	137	261	275	245	127	70	16	7
Construction	5	23	45	47	42	22	12	3	1
Food Mfg.	1	4	7	7	6	3	2	0	0
Wood Mfg.	0	0	0	0	0	0	0	0	0
Other Mfg.	23	100	192	201	180	93	51	12	5
Transportation	3	11	21	22	20	10	6	1	0
Ret. & Whls. Trade	630	2789	5323	5596	4995	2586	1420	329	144
Banking	23	102	194	204	182	94	52	12	5
Other Finance	22	97	185	194	173	90	49	11	5
Services	308	1362	2600	2733	2440	1263	694	161	70
Local Gov't	56	246	469	493	440	228	125	29	13
Household	51	224	428	450	402	208	114	26	12

^{a/}The data reported are in terms of June, 1974 prices.

Table 8 . Total Local Final Demand by Sector Including Pre-Project Sales and Project Payroll Expenditures in the Bath-Highland-Pocahontas Counties Region by Project Year (thous. \$)^{a/}

Sector	Pre-Project	Project Year								
		1	2	3	4	5	6	7	8	9
Agriculture	8743	8774	8880	9004	9017	8988	8870	8812	8759	8750
Construction	5568	5573	5591	5612	5615	5610	5589	5580	5571	5569
Food Mfg.	444	445	447	450	451	450	447	445	444	444
Wood & Wood Prod.	3930	3930	3930	3930	3930	3930	3930	3930	3930	3930
Other Mfg.	4315	4337	4415	4506	4516	4494	4408	4366	4326	4320
Transportation	503	506	515	525	526	523	514	509	505	504
Ret. & Whlse. Trade	9362	9990	12149	14683	14956	14355	11945	10780	9689	9504
Banking	225	251	330	423	443	411	323	280	240	234
Other Finance	44	66	141	229	238	217	134	93	55	49
Services	1269	1624	2679	3916	4049	3756	2579	2010	1477	1387
Local Gov't	2636	2692	2882	3105	3130	3077	2864	2762	2666	2650
Household	14026	14077	14250	14454	14476	14428	14234	14140	14052	14038

^{a/}The data reported are in terms of June, 1974 prices.

in the BHP economy. Based on the final demand vectors in Table 8, the total estimated sales by sector for each of the nine project years are reported in Table 9.

The change in employment levels, in man-years, necessary to produce the total output in the various years are also shown in Table 9. These employment levels are derived by multiplying the labor-output ratios derived from the USBV region study for each sector by the sector's increase in output.

An analysis of current unemployment and under-employment in the three county study region shows that 600 workers could be available to meet the increased demand for labor resulting from the changes in final demand. This increase in employment would be in addition to the increase due to employment at the construction project. Six hundred workers would be available to meet the demands for labor resulting from the expenditures of the project employees and the resulting increase in economic activity.

It is apparent from Table 9 that 600 workers would not be sufficient to meet the labor demands of the economy during the peak construction period. For example, the number of workers required locally as a result of the expenditure of the construction payroll would be 1662 in the fourth year if households are assumed to be endogenous. The inclusion of households as an endogenous sector means that estimates will be based on the assumption that all payments for the additional labor are made to local households and that respending is thus a fixed portion of those payments. If it is assumed that any labor demands in excess of the 600 locally available will be met

Table 9 . Total Sales and Employment Increases by Sector Generated by Pre-Project and Project Payroll Expenditure Final Demands in the Bath-Highland-Pocahontas Counties Region by Project Year (thous. \$)^{a/}

Sector	Project Year								
	1	2	3	4	5	6	7	8	9
Agriculture	9869	10027	10212	10223	10189	10012	9927	9850	9834
Construction	6019	6084	6162	6170	6152	6079	6043	6012	6004
Food Mfg.	703	713	726	727	724	713	707	702	701
Wood Product	4000	4001	4003	4003	4002	4001	4001	4000	4000
Other Mfg.	5043	5192	5368	5387	5345	5178	5098	5026	5010
Transportation	1021	1095	1182	1192	1171	1089	1049	1014	1005
Ret. & Whls. Trade	25042	28614	32807	32261	32265	28278	26350	24628	24238
Banking	1032	1185	1365	1394	1342	1171	1089	1015	998
Other Finance	575	697	840	856	822	686	620	562	548
Services	7449	8989	10796	10992	10566	8844	8013	7566	7103
Local Gov't	4093	4410	4783	4824	4735	4380	4209	4057	4021
Household	42484	45976	50075	50524	49546	45648	43763	42253	41699
Necessary Increase in Employment (Man/Years)	187	828	1580	1662	1482	767	422	148	43

^{a/}The data reported are in terms of June, 1974 prices. It is assumed in these sales estimates that the necessary increase in man years of employment can be met by the local labor force of the region (i.e., the household sector is endogeneous in the I/O model).

through in-commuting, the model will overstate the effect of the final demand vectors in the years that in-commuting occurs.^{13/} This overstatement would occur because in-commuters would not be assumed to spend a significant amount of their wages in the BHP region.

Local Impact of Project Labor Expenditures
With Labor Resource Constraints

To account for the presumed in-commuting discussed above, a two part I-O model of the local economy was developed. The first part consisted of the I-O model with households as an endogenous sector and was used to determine the impact of the final demand vectors upon the local economy up to the point at which the local labor supply was exhausted. This point is determined by linear interpolation as changes in final demand and changes in employment are linearly related by the labor-output ratios. It was assumed that any increase in final demand above this level would result in in-commuting. An I-O model with households exogenous was used to analyze the economy after this point as it is assumed that there will be no respending locally of payments to in-commuters.

It is important to note that the division of the local economy in this manner does not involve any assumptions concerning the functioning of an economy that are not made when conducting the usual form of impact analysis.

Estimates of sectoral output in the years in which the two-part analysis was appropriate were found by subtracting "capacity" final

^{13/}The labor pool within reasonable commuting distance was found to be sufficient to supply these excess labor demands.

demand from total final demand. The impact of the resulting "excess capacity" final demand vector was determined with households assumed to be exogenous (i.e., all payments for labor were assumed to accrue to individuals outside the region with no local responding). These increases were then added to the output levels of the sectors found to occur at "capacity" final demand with households treated endogenously.

This two-part analysis was conducted only in years two through six of the construction period when local labor resource constraints came into effect. The estimates of output levels for the sectors for those years are shown in Table 10. In Table 11, the ratios of the estimates for the relevant project years comparing the endogenous household sector model to the two-part model are reported.

The estimates of sectoral output differ to the greatest extent during the peak construction years of the project. The assumption that the local labor supply is sufficient to fully meet local demands thus leads to an overstatement of the effect of large relative changes in the final demand vectors.

Project Labor Expenditure Impact by
County of the Study Region

The I-O model utilized above permitted estimation of the impact of project expenditures for the three county BHP region. The direct changes in final demand will not occur in the individual counties in the same proportions as pre-project sales levels of the counties because the residences of project employees will not be distributed among the counties in the same proportions as were pre-

Table 10. Total Sales by Sector Generated by Preproject and Project Payroll Expenditure Final Demands in the Bath-Highland-Pocahontas Counties Region by Project Year with Regional Labor Supply Constraints (thous. \$)^{a/}

Sector Year	Project Year				
	2	3	4	5	6
Agriculture	1001	10141	10155	10125	10000
Construction	6078	6132	6138	6125	6074
Food Mfg.	712	721	722	720	712
Wood Mfg.	4001	4002	4002	4002	4001
Other Mfg.	5177	5300	5314	5284	5167
Transportation	1088	1149	1156	1141	1083
Ret. & Whls. Trade	28240	31190	31508	30809	28003
Banking	1171	1286	1312	1281	1160
Other Finance	685	785	796	772	676
Services	8828	10100	10237	9935	8726
Local Govt.	4377	4640	4668	4606	4356
Household	44739	44739	44739	44739	44739

^{a/}The data reported are in terms of June, 1974 prices. It is assumed in these sales estimates that the necessary increase in man years of employment can only be met by the local labor force up to a limit of 600 employees. Beyond this limit, additional employees are assumed to be in-commuters to the region (i.e., after an employment increase of 600, the household sector becomes exogeneous in the I/O model).

Table 11. The Ratio of Total Sales by Sector Generated by the Two-Part Model With Labor Supply Constraints to Total Sales by Sector Generated by the Model Without Labor Supply Constraints in the Bath-Highland-Pocahontas Counties Region by Project Year

Sector	Project Year				
	2	3	4	5	6
Agriculture	.998	.993	.993	.994	.999
Construction	.999	.995	.995	.996	.999
Food Mfg.	.999	.993	.993	.994	.998
Wood Mfg.	1.00	1.00	1.00	1.00	1.00
Other Mfg.	.997	.987	.986	.989	.997
Transportation	.993	.972	.969	.974	.994
Ret. & Whls. Trade	.986	.951	.947	.955	.990
Banking	.987	.942	.941	.955	.991
Other Finance	.982	.935	.930	.939	.986
Services	.982	.935	.931	.940	.987
Local Govt.	.992	.970	.968	.973	.995
Household	.973	.893	.885	.903	.980

project sales. The estimation of sales changes in a county cannot, therefore, be made by merely allocating total sales changes on the basis of the proportion of total pre-project sales of the region occurring in a particular county.

The total sales changes in each of the counties consist of the direct final demand change expected in the county plus a portion of the total induced and indirect sales change. It was assumed that the indirect and induced sales occurring in the individual counties as a result of the payroll expenditure would be in the same proportion to the total regional induced and indirect sales changes as the pre-project sales of the counties are to the total pre-project sales level of the region. Total sales changes were estimated for Bath and Highland Counties.

The direct sales change in Bath County was estimated by multiplying the total regional estimated change in final demand by the proportion of that total expected to occur in Bath County. That proportion was assumed to be equal to the proportion of the project employees weighted by their expected consumption patterns, expected to reside in Bath County. It has been estimated that 47% of the project labor force will reside in Bath County temporarily while 11.5% will be permanent residents of BHP who commute to the project. It is estimated that one-third of these commuters will be residents of Bath County. The proportion of the payroll to be spent in Bath County is thus estimated to be .54 ($.47 + .33 \times .115 \times 2$ -- .115 is multiplied by 2 because the commuters who are residents of the area, spend twice as much locally as the temporary residents). Each of the re-

gional sectoral final demand changes are multiplied by .54 to estimate the direct sales changes for Bath County shown in Table 12.

The direct sales changes in Highland County are estimated in an analogous fashion. It is expected that 30% of the project employees will locate temporarily in Highland County. It is estimated that one-sixth of the commuters from within the region will be residents of Highland County. The proportion of the payroll spent in Highland County is thus estimated to be .34 ($.30 + .167 \times .115 \times 2$). The estimated direct sales changes for Highland County are shown in Table 13.

Those sectors which had no pre-project sales in Bath and Highland Counties are assumed to continue to have no sales and the demand for the products of those sectors are assumed to be met by firms located in Pocahontas County. This assumption is not restrictive because the sectors not present in Bath and Highland Counties are not significant in size relative to the other sectors. Estimates of pre-project sales levels in Bath and Highland Counties are shown in Table 14.

The BHP regional indirect and induced sales changes for the project years one, seven, eight and nine were estimated by subtracting the direct sales changes from the total sales change. These indirect and induced regional sales change levels were then multiplied by the ratio of the particular county's pre-project sales levels to the regional total for each sector to obtain the indirect and induced changes for the counties for the above years.

Table 12. Local Increases in Final Demand by Sector from Project Payroll Expenditures in Bath County by Project Year
(thous. \$)^{a/}

Sector	Project Year								
	1	2	3	4	5	6	7	8	9
Agriculture	17	74	141	148	132	69	38	9	4
Whls. & Ret. Trade	340	1506	2874	3022	2698	1396	767	178	78
Banking	12	55	105	110	99	51	28	6	3
Other Finance	12	52	100	105	94	48	27	6	3
Services	166	736	1404	1476	1317	682	374	87	40
Local Gov't.	30	133	253	266	254	123	68	16	7
Households	27	88	88	88	88	88	62	14	6

^{a/}The data reported are in terms of June, 1974 prices.

Table 13. Local Increases in Final Demand by Sector from Project Payroll Expenditures in Highland County by Project Year (thous. \$)^{a/}

Sector	Project Year								
	1	2	3	4	5	6	7	8	9
Agriculture	10	46	89	93	8	4	24	6	2
Construction	2	8	15	16	14	7	4	1	0
Other Mfg.	3	34	65	68	61	32	17	4	2
Ret. & Whls. Trade	214	948	1810	1902	1698	879	483	112	3
Banking	8	35	66	70	62	32	18	4	2
Other Finance	7	33	63	66	59	30	17	4	2
Services	105	463	884	929	830	429	236	55	2
Local Gov't.	19	83	159	168	150	77	42	10	4
Households	17	55	55	55	55	55	39	9	4

^{a/}The data reported are in terms of June, 1974 prices.

Table 14. Total Pre-Project Sales Levels by Sector in Bath and Highland Counties by Project Year (thous. \$)^{a/}

Sector	Bath	Highland
Agriculture	2145	4825
Construction	1857	1020
Food Mfg.	0	0
Wood Mfg.	941	941
Other Mfg.	0	189
Transportation	0	0
Ret. & Whls. Trade	6800	2400
Banking	246	297
Other Finance	110	55
Services	2000	1000
Local Gov't	1100	550
Households	11177	5653

^{a/}The data reported are in terms of June, 1974 prices.

The regional indirect and induced sales changes for the project years two, three, four, five and six were estimated by, first, subtracting the pre-project sales levels from the "capacity" sales levels to obtain the sales changes at "capacity" (these will be constant for the above years). Second, the sales levels from the excess capacity final demand (using the two-part) exogeneous household model, were subtracted from the pre-project sales levels (these differences will vary from year to year for each sector). These differences were then summed to obtain the total regional sales changes in each sector and the direct sales changes were then subtracted to obtain the regional induced and indirect sales changes. These sales changes were then multiplied by the ratio of the county's pre-project sales to total regional sales to obtain the indirect and induced sales changes of a particular county. These sales changes are shown in Tables 15 and 16 for Bath and Highland Counties, respectively. Tables 15 and 12 and Tables 16 and 13 were then summed to yield Tables 17 and 18, which show the estimated sectoral sales changes for the project years in Bath and Highland Counties, respectively.

Local Impact of Project
Recreational Facilities

The preceding analysis was confined to estimating the economic impact of the expenditures of employees of the VEPCO project. Included in the proposed project are facilities for recreational and sightseeing activities. It is estimated that initial use of these facilities will be 70,500 annual visitor-days increasing to 83,000

Table 15. Total Indirect and Induced Sales by Sector Generated by Project Payroll Expenditure Final Demands in Bath County by Project Year (thous. \$)^{a/}

Sector	Project Year								
	1	2	3	4	5	6	7	8	9
Agriculture	4	11	12	13	12	11	8	3	1
Construction	4	17	27	28	26	11	10	3	1
Ret. & Whls. Trade	117	411	528	541	513	401	263	84	27
Banking	5	20	29	30	28	19	12	4	1
Other Finance	3	10	12	13	12	10	6	2	1
Services	40	133	143	144	142	94	91	30	9
Local Gov't	10	36	47	48	46	35	23	8	2
Households	261	837	837	837	837	837	589	206	60

^{a/}The data reported are in terms of June, 1974 prices.

Table 16. Total Indirect and Induced Sales by Sector Generated by Project Payroll Expenditure Final Demands in Highland County by Project Year (thous. \$)^{a/}

Sector	Project Year								
	1	2	3	4	5	6	7	8	9
Agriculture	8	25	28	28	28	24	17	6	2
Construction	2	9	43	45	41	25	5	2	1
Other Mfg.	1	3	4	4	4	3	2	1	0
Ret. & Whls. Trade	41	145	187	191	181	142	93	30	9
Banking	6	24	35	36	33	23	15	5	2
Other Finance	1	5	6	6	6	5	3	1	0
Services	20	65	70	71	69	65	45	15	4
Local Gov't	5	18	24	24	23	18	12	4	1
Households	136	423	423	423	423	423	306	106	31

^{a/}The data reported are in terms of June, 1974 prices.

Table 17. Total Sales Changes by Sector Generated by Project Payroll Expenditure Final Demands in Bath County by Project Year (thous. \$)^{a/}

Sector	Project Year								
	1	2	3	4	5	6	7	8	9
Agriculture	20	85	153	161	145	80	45	9	4
Construction	7	30	51	53	48	28	16	4	2
Ret. & Whls. Trade	457	1917	3403	3563	3211	1797	1030	262	104
Banking	18	75	134	140	126	70	40	10	4
Other Finance	15	62	112	118	106	58	33	8	3
Services	207	869	1447	1620	1459	776	466	117	49
Local Gov't	40	169	300	314	299	158	91	23	9
Households	288	924	924	924	924	924	651	230	66

^{a/}The data reported are in terms of June, 1974 prices.

Table 18. Total Sales Changes by Sector Generated by Project Payroll Expenditure Final Demands in Highland County by Project Year (thous. \$)^{a/}

Sector	Project Year								
	1	2	3	4	5	6	7	8	9
Agriculture	18	71	117	122	110	68	41	11	4
Construction	4	17	58	61	55	33	9	2	1
Other Mfg.	8	37	69	73	65	35	19	5	2
Ret. & Whls. Trade	255	1093	1997	2093	1879	1021	576	142	12
Banking	14	59	101	105	95	55	32	9	3
Other Finance	9	38	69	72	65	35	20	5	2
Services	124	528	954	1000	899	494	281	69	28
Local Gov't	24	101	183	192	173	95	54	14	6
Households	153	478	478	478	478	478	345	116	4

^{a/} The data reported are in terms of June, 1974 prices.

annual visitor-days by the year 2000.^{14/} The individuals using these facilities are expected to make expenditures in the BHP region and such expenditures will have an impact on the local economy.

The estimation of the annual expenditures of recreational visitors to the VEPCO project in the BHP region was made by estimating the visitor-day expenditures of the typical visitor based on previous studies of the expenditures of visitors to similar, relatively isolated recreational sites in the surrounding areas. The estimates of the expenditures of the typical visitor to the facilities on various goods and services are shown in Table 19.

It was assumed, for purposes of analysis, that the expenditures of visitors to the facilities would occur only in Bath County as it is felt that expenditures by visitors in Highland Pocahontas Counties would not be of a significant level. This assumption was made because the facilities are located in Bath County and because the highways giving access to the facilities and the major population centers expected to be sources of visitors are located such that most individuals traveling to the facilities will pass only through Bath County.

Aggregating the estimated typical expenditures per visitor-day on the basis of the sectors used in the impact analysis above, and multiplying by the expected annual initial visitor-days it is found that the expected annual expenditures of visitors to the facilities

^{14/} Federal Power Commission, Final Environmental Impact Statement - Bath County Project No. 2716 - Virginia (Washington, D.C.: U.S. Government Printing Office, September, 1975).

Table 19. Estimated Expenditure by Type of Establishment Made by Recreational Visitors Per Visitor-Day (\$) ^{a/}

Type of Establishment	Amount
Lodging	.40
Cafes & Taverns	.75
Service Stations	.75
Grocery Stores	1.00
Other	.30
Total	\$3.20

^{a/} Wilson E. Schmisser, Russell C. Youmans and William Boedt, Economic Impact of Public Investments in Small-Boat Facilities and State Parks in the Lower Umpqua River Area of Douglas County, Oregon, Water Resources Research Institute Publication WRI-30 (Corvallis, Oregon: Oregon State University, March, 1975) and Marion Clawson and Jack L. Knetsch, Economics of Outdoor Recreation (Baltimore, Md.: The John Hopkins Press, 1966). The estimate of average expenditure on lodging is based on the current number of motel and hotel units expected to provide lodging for visitors to the recreational facilities. It is less than half that found in similar areas with relatively more units and indicates a possible potential for an increase in the numbers of such units in the area.

are \$28,200 in the service sector and \$197,400 in the retail and wholesale trade sector. The determination of the impact of these expenditures on the BHP economy was made in a manner analogous to the impact analysis made of project labor expenditures. The pre-project sales levels of the various sectors in BHP, the sales levels of the various sectors expected if the only changes in expenditures were those of visitors to the facilities, and the change in sales levels expected as a result of the expenditures of visitors to the facilities are shown in Table 20.

Of the sales level changes shown above, all but those of the retail and wholesale trade and services sectors are indirect and induced changes. The sales level changes of the retail and wholesale trade are both direct (\$197,400) and indirect and induced (\$84,600 = \$282,000 - \$197,400) as are those of the services sector with (\$28,200 of direct sales and \$25,800 of indirect and induced sales). All the direct sales changes are assumed to occur in Bath County. The indirect and induced sales changes are assumed to occur in the counties of the BHP region proportional to the counties' portion of total pre-project sales. Following this procedure, Table 21 shows the direct and/or indirect and induced sales level changes in Bath and Highland Counties, resulting from the expected expenditures of visitors to the project recreational facilities.

There are two separate areas of recreational facilities, the "Recreational Ponds Area" (RPA) and the "Lower Dam Area" (LDA). The LDA is scheduled to open at the completion of the pump-storage facilities while the time of opening of the RPA has not been definite-

Table 20. Pre-Project Sales Levels and Sales Levels Generated by Project Recreational Facilities Expenditures by Sector for the Bath-Highland-Pocahontas Counties Region (thous. \$)^{a/}

Sector	Pre-Project Sales	Sales with Visitor Expenditures	Change in Sales
Agriculture	9821	9823	2
Construction	6000	6003	3
Food Mfg.	700	700	0
Wood Mfg.	4000	4000	0
Other Mfg.	5000	5004	4
Transportation	1000	1004	4
Ret. & Whls. Trade	24000	24282	282
Banking	988	992	4
Other Finance	540	543	3
Services	7000	7054	54
Local Gov't	4000	4006	6
Households	41452	41653	201

^{a/} These data are in terms of June, 1974 prices.

Table 21. Total Sales Level Changes by Sector Generated by Project Recreational Facilities Expenditures in Bath and Highland Counties (thous. \$)^{a/}

Sector	Bath	Highland
Agriculture	.5	1.0
Construction	.9	0.5
Food Mfg.	0	0
Wood Mfg.	0	0
Other Mfg.	0	0
Transportation	0	0
Ret. & Whls. Trade	221	8.5
Banking	1.0	1.2
Other Finance	0.6	0.3
Services	35.6	3.6
Local Gov't	1.7	0.8
Households	54.3	28.1

^{a/} These data are in terms of June, 1974 prices.

ly set.^{15/} The RPA could open as the third year of the construction period or as last as the LDA (in the seventh year of the construction period).

In the above analysis, estimates were made of the sales changes resulting from the expenditures of visitors to both of these areas. These estimates will not be accurate, if the RPA opens prior to the LDA, for the period of operation of the RPA alone. The above estimates will apply in the periods following the opening of the RPA, regardless of whether or not the RPA opens prior to the LDA. The above estimates are based on the initial use estimates of the facilities. There is expected to be an increase in the use of these facilities over time up to a capacity of 83,000 visitor-days in the year 2000.^{16/} It is expected that this increase would occur linearly and that the expenditures by visitors would therefore also increase linearly up to the year 2000.

The above estimates of sales level changes can, thus, be adjusted to obtain estimates for any particular year merely by multiplying the estimated sales changes by the ratio of the expected visitor-days in that year (found by linear interpolation) to the initial use estimate (70,500 visitor-days).

^{15/} Ibid.

^{16/} Ibid.

Local Impact on Government Revenues
and Expenditures

The VEPCO project is expected to result in substantial changes in the levels demanded of various public services in Bath and Highland Counties and in the revenues which those counties receive both from local and non-local sources. Projections of changes in county government expenditures needed to meet the changing demands for public services and changes in county government revenues resulting from the VEPCO project will be made for those services and revenue sources which would be expected to be significantly affected by the project.

The sources of revenue which were examined are the same in the two counties. It has been estimated after a review of past personal property taxation practices in Bath and Highland Counties that the temporary residents of both counties will pay \$40 per worker in personal property taxes. The personal property tax revenues resulting from the residency of the construction labor force in the two counties were estimated by multiplying the number of workers expected to temporarily reside in the counties in a given year by the \$40 per worker tax estimate.

The county receives one-fourth of the four percent sales tax collected by the state on local retail sales without stipulations as to its use. These "general sales tax" revenues were estimated by multiplying the expected changes in retail sales in the counties found in the preceding analysis by one percent (following adjustments in the expected changes necessitated by the exemption of motor vehicles and motor vehicle fuels from sales taxation).

The state returns a portion of total sales taxes to the counties to be used only for educational purposes. The amounts returned depend upon the size of the census school population in a county relative to the state census school population. The populations are compared at three year intervals and thus the revenues from this source will lag the changes in school-age population and will not reflect the year by year changes expected to occur because of project construction. The only expected cause for variation within a three year period following a comparison of the county school-age population with that of the state is a statewide increase in sales tax revenues during the period.

The state also provides revenues for educational purposes based upon the average daily membership (ADM) in a county's schools. First, the ADM is multiplied by \$730 and the school sales tax due the county subtracted from it, then this figure is multiplied by the "composite index" relevant to the county. This figure is then multiplied by .5 in order to obtain the ADM revenues. The ADM revenues are calculated on an annual basis. The subtraction of the school sales tax figure from the product of the ADM times \$730 will only partially offset the effects of the three year lag in the calculation of school sales tax revenues because the resulting figure is multiplied by .5.

The changes expected in revenues, from the above sources over the nine year period of analysis for Bath and Highland Counties are shown in Tables 22 and 23, respectively.

Table 22. Expected Changes in Bath County Local Government Revenues Resulting from the VEPCO Project (\$)

Revenue Source	Project Year								
	1	2	3	4	5	6	7	8	9
Personal Property Tax	3400	5640	25560	47880	48920	31760	9680	3600	2880
General Sales Tax	4620	20545	38655	42910	41038	24255	14740	3986	5245
School Sales Tax	0	22487	24646	27012	103724	113682	124595	9675	
ADM School Revenues	21013	51683	188468	226719	171021	28118	36378	10966	
Total Revenue (at expected prices)	29033	100355	277330	344520	364703	197815	112637	28227	5245

Table 23. Expected Changes in Highland County Local Government Revenues Resulting from the VEPCO Project (\$)

Revenue Source	Project Year								
	1	2	3	4	5	6	7	8	9
Personal Property Tax	2176	3610	16358	30643	31309	20326	6195	2304	1843
General Sales Tax	2584	11743	22678	25235	24012	13785	8236	2162	338
School Sales Tax	0	14392	15773	17288	65743	72756	79741	6192	
ADM School Revenue	13448	33077	120620	145101	109453	17996	-23282	7018	
Total Revenue (at expected prices)	18210	62822	175429	218267	230520	124863	70890	17676	2181

The VEPCO project is scheduled to begin operation in the seventh and eighth project years and it is estimated to produce real estate taxes of 3.5 million dollars annually for Bath County.^{17/}

The influx of workers and the increased economic activity in the area will probably lead to an increase in the value of real estate in Bath and Highland Counties. This increase would be a result of an increase in the value of properties in their current state and of the development of properties. The uncertainty regarding the extent of these changes and the assessment practices of the counties preclude an estimation of the resulting changes in real estate tax revenues.

Two previous studies have concluded that the presence of the VEPCO project labor force will lead to increased demands for public services provided by the counties and to increases in administrative costs of the county governments.^{18/}

Detailed budgets were developed for Bath County by the Shenandoah Planning Commission in order to estimate the costs of providing the increased levels of public services necessitated by the presence of the VEPCO project workers in the County. These estimates are

^{17/} Based on statements by Stanley Ragone, VEPCO Senior Vice President and A. M. Clement, VEPCO Treasurer.

^{18/} B. F. Long and J. P. Marshall, "Impact of a Construction Worker Community on a Rural County: A Case Study," Evaluating Impacts of Economic Growth Proposals (Ithaca, New York: Northeast Regional Center for Rural Development, Cornell University, April, 1975) and Rod W. Smith, A Study of the Areas of Primary Budget Impact Upon Bath County, Virginia VEPCO Pumped Storage Project, (Staunton, Virginia: Central Shenandoah Planning Commission, Nov., 1975).

shown in Table 24.^{19/} (Solid waste disposal was originally included as a service requiring additional funding levels, but was omitted because it is felt that user charges will be employed to cover additions in costs.)

Estimates of the increased expenditures of Highland County were made under the assumption that law enforcement, schooling and county administrative costs would increase equally in Bath and Highland Counties per temporary resident.

It is felt that the concentration of the temporary workers in the proposed construction worker community in Highland County will result in fire protection being provided specifically for that site by the firm contracted to manage the site. No increases, therefore, in county expenditures for fire protection purposes are anticipated in Highland County. The expenditures per temporary resident for health services are expected to differ substantially between Highland and Bath Counties due to the greater distance from adequate medical facilities in Highland County. The estimates made for Highland County thus include expenditures to staff a Health Outreach Clinic as estimated by Long and Marshall.^{20/} The estimates of increased expenditures in Highland County are shown in Table 25.

Summary

In this chapter, the regional economic impact of the proposed VEPCO hydroelectric facility was analyzed. The analysis was made in

^{19/}Rod W. Smith, op. cit.

^{20/}B. F. Long and J. P. Marshall, op. cit.

Table 24. Expected Changes in Bath County Local Government Expenditures Resulting from the VEPCO Project (\$)

	Project Year								
	1	2	3	4	5	6	7	8	9
Fire Protection	8782	9130	9584	10083	10633	7837	8502	9234	
Health Services	20285	25484	26255	27093	29612	27203	28283	29458	
Law Enforcement	3943	9145	9819	10543	11321	12158	13058	14026	
Schools	30305	176521	686569	816567	788278	298531	92538	54815	
County Administration	3712	15560	41155	53430	55810	28411	15397	13424	
Total	68671	241386	794363	944782	1024796	385445	161620	123744	

Table 25. Expected Changes in Highland County Local Government Expenditures Resulting from the VEPCO Project (\$)

	Project Year								
	1	2	3	4	5	6	7	8	9
Health Services		93260	39300	41650	44150	46860	49500		
Law Enforcement	2524	5853	6284	6748	7245	7798	8357	8977	
Schools	19395	102300	406900	512707	490000	180000	55800	31241	
County Administration	2375	9960	26340	34195	35720	18183	9854	8591	
Total	24294	211373	478824	600300	577115	252841	123510	48809	

terms of nine project years. During the first seven years, the project's impact was assumed to occur principally through local expenditures of construction workers' payrolls. In the eighth year, construction would be completed and the longer-run impact of facility operation and maintenance workers expenditures enters the analysis. In the ninth year, only this long-term operation and maintenance workers' expenditures impact on the regional economy was considered.

Using input-output methodology, the expenditures of construction workers were estimated to have a major impact in terms of increasing the sales of the retail and wholesale trade and services sectors of the study region. The longer-term impacts of operation and maintenance worker expenditures and recreational facilities users were small relative to the construction worker expenditure impact. This implies a substantial short-run increase in regional economic activity which will be required to adjust downward when the project's construction phase is completed.

The impact of the project on the region's economy was examined without and with constraints on the local labor supply required for employment to meet the demands of increased economic (non-project) activity in the region. If a constraint in terms of local labor supply is encountered, it was found that the amount of increased economic activity estimated without labor constraints would be an overestimate. This reflects the importance to local economic activity levels of the induced respending effect of labor income by local residents.

The impacts of the project on local government revenues and expenditures in Bath and Highland Counties were examined. Although it is difficult to accurately estimate these changes in revenues and expenditures, based on revenue structures and previous studies, it appears that increased local government expenditures will be greater than the estimated increase in revenues.

CHAPTER IV

ANALYSIS OF THE RECREATIONAL FACILITIES INCLUDED IN THE PROPOSED HYDROELECTRIC FACILITY

Introduction

Title 18, Section 4.41 of the Code of Federal Regulations consists of a list of various exhibits which must be filed as a condition for the review of an application to the Federal Power Commission (FPC) for a license to construct a hydroelectric facility. Exhibit R of Section 4.41 is to consist of "a proposed plan for full public utilization of project waters and adjacent lands for recreational purposes so far as consistent with proper operation of the project for the development of water power and other public purposes."^{1/}

The recreational facilities proposed in the project plan submitted by VEPCO consist of a "Lower Dam Area" (LDA) and a "Recreation Ponds Area" (RPA). The LDA would be adjacent to the dam of the lower of the two pump storage reservoirs and would be primarily for day-use visitors designed to provide a pleasant environment for those

^{1/}United States Code of Federal Regulations (Washington, D.C.: U.S. Government Printing Office), Title 18, Section 4.41.

wishing to view the pump storage facility.^{2/} The RPA would be located approximately one-half mile below the lower reservoir dam. It would consist of two ponds, totaling approximately 80 acres, and the adjacent land will have facilities for camping, hiking, picnicking, swimming, boating and fishing. Only the RPA will be considered in the analysis of this chapter because of the low-level type use of the LDA.

A benefit-cost analysis for the purpose of determining the desirability of the RPA may be approached from either national or local perspectives or "accounting stances." The national accounting stance is appropriate if the objective is to determine whether or not the RPA results in a net improvement in the "well-being" of society, as a whole, as measured by the prices attached to the resources consumed by, and the benefits resulting from, the construction and operation of the RPA. The local accounting stance is appropriate in determining the net effect of the RPA on the well-being of the people of the BHP region.

Benefit-Cost Analysis of the RPA
with a National
Accounting Stance

The recreational ponds area (RPA) of the proposed VEPCO project would consist of a 55 acre pond, a 27 acre pond, and approximately 160 acres of the surrounding land with facilities for various outdoor recreational activities.

^{2/} Federal Power Commission, Final Environmental Impact Statement - Bath County Project No. 2716 Virginia (Washington, D.C.: U. S. Government Printing Office, September 1975).

The expected costs of the RPA consist of the initial investment or construction costs incurred during a two year construction period and the operation and maintenance costs incurred during the life of the RPA.^{3/} The initial investment costs for the construction of the RPA are shown by item for each of the two years of construction in Table 26.

Operation and maintenance (O&M) costs will be incurred in the last quarter of the year in which construction is completed and in each of the following fifty years of the assumed life of the RPA. O&M costs for both the RDA and LDA recreational facilities have been estimated at \$60,000 annually.^{4/} O&M costs for the RPA were estimated by allocating the portion of total O&M costs to the RPA using the ratio between the expected user-days of the RPA to the expected total user-days of both the RPA and LDA. O&M costs for the last quarter of the year of the completion of the RPA are thus estimated to be \$12,120 and for subsequent years to be \$48,480 except in those years in which major expenditures are expected for the replacement of park structures and facilities.^{5/} The FPC has found the useful life

^{3/} Federal Power Commission, op. cit.

^{4/} Federal Power Commission, op. cit.

$$\text{\$}12,120 = \frac{56,200}{70,500} \times \$60,000 \times .25$$

$$\$48,480 = \frac{56,200}{70,500} \times \$60,000$$

Table 26. Initial Investment Costs for Construction of the Recreation Ponds Area of the VEPCO Project by Construction Year.^{a/}

Item	Cost (\$)
<u>First Year of Construction</u>	
Boat Launch	\$ 39,200
Landscaping	197,000
Pond Construction (excluding excavation costs) ^{b/}	53,000
Engineering ^{c/}	174,247
Land ^{d/}	80,000
Total	\$ 543,547
<u>Second Year of Construction</u>	
Picnic Area	\$ 101,800
Swimming Beach	156,500
Hiking Trails	70,800
Campground	73,000

^{a/} Source: Federal Power Commission, Final Environmental Impact Statement - Bath County Project No. 2716, Virginia (Washington, D.C.: U.S. Gov't Printing Office, September, 1975). All costs are computed at June, 1974 price levels.

^{b/} Excavation costs are not included because the fill removed will be used in the construction of the dams of the hydroelectric facility. These costs are included in the estimates of the cost of the RPA made in the FPC impact statement.

^{c/} Engineering costs were estimated by allocating a portion of total engineering costs of all recreational facilities to the RPA in the same ratio that the construction costs of the RPA are to total construction costs.

^{d/} It was estimated the two-thirds of the total land purchased for recreational use would be used for the RPA.

Table 26. (Continued)

Item	Cost (\$)
Roads	118,300
Misc. Signs	2,300
Sewage, Water and Electrical Systems ^{e/}	245,600
Congingencies ^{f/}	261,370
Total	<u>\$1,029,670</u>

^{e/} The sewage, water and electrical systems costs were estimated by allocating a portion of total sewage, water and electrical systems costs to the RDA in the same ratio as expected user-days of the RPA are to total expected user-days.

^{f/} Contingency costs were allocated in the same manner as engineering costs.

of park structures and facilities averages 18 years.^{6/} The cost of replacing structures and facilities was estimated to be \$174,800 and this cost was added to O&M costs in the eighteenth and thirty-sixth year of the operation of the RPA.

The benefits of the RPA result from its use as a site for various recreational activities. It was estimated that the initial use of both the RPA and LDA recreational facilities will be 70,500 user-days annually increasing to 83,000 user-days by the year 2000.^{7/} The initial annual use of the RPA was estimated by summing the user-day estimates for those activities which could only occur in the RPA with portions of the estimated user-days of those activities common to both recreational areas. The user-day estimates, for activities common to both areas, for the RPA were made by assuming that the user-days of those activities in the RPA would be in the same proportion to total user-days of those activities as the number of facilities for those activities in the RPA are to the total number of facilities. The initial annual user-days estimated for the RPA are shown in Table 27.

It is assumed that the increase in user-days at the RPA will be proportional to the expected increase in total recreational use and that the increase will be linear. A different use level was es-

^{6/}Federal Power Commission, ^ECreation Facility Costs and Design Use (Washington, D.C.: U.S. Government Printing Office, December, 1970).

^{7/}Federal Power Commission, Final Environmental Impact Statement - Bath County Project No. 2716, Virginia (Washington, D.C.: U.S. Government Printing Office, September, 1975).

Table 27. Initial Annual User-Day Estimates for the Recreation Ponds Area of the VEPCO Project

Recreational Activity	Annual User-Days
Fishing	12,000
Rowboating	10,800
Beach Use	13,500
Family Picnicking	11,787
Group Picnicking	3,400
Family Camping	5,500
Total Annual RPA User-Days	56,987

timated by year until the peak use is reached in the twentieth year. The midpoint of the range of the dollar valuations of "general" user-days employed by federal agencies was used in estimating the benefits of the RPA. The range is from \$.75 to 2.25 and the midpoint is \$1.50.^{8/} The interest rate of 6.125 percent currently in use by federal agencies in discounting future benefits and costs was used in the discounting computations.^{9/} Benefit-cost ratios of .457, .914, and 1.371 were obtained when the lowest, the midpoint and the highest of the dollar valuations of user-days were used, respectively.

Consideration of the RPA with a
Local Accounting Stance

The effect of the RPA on the net well-being of the people of the BHP region will differ substantially from the effect on society as a whole. All of the benefits of the project resulting from recreational use do not accrue to area residents and the RPA will have effects which can be considered as benefits from a local accounting stance, but not from a national accounting stance. In addition, the cost of the RPA will not be borne to a significant extent by residents of the BHP region.

^{8/} Water Resources Council, Water and Related Land Resources - Establishment of Principles and Standards for Planning (Washington, D.C.: U.S. Government Printing Office, September, 1973).

^{9/} Ibid.

The recreational use of the RPA by BHP residents is expected to be substantial even though the majority of the users would not be expected to be from the area. A significant result of the use of the RPA which would be considered a benefit to the BHP region without being a benefit to the Nation would be an increase in value-added from the sales to visitors to the region. This is not a national benefit because the money expended by visitors would be expended elsewhere resulting in the same approximate increase in value-added. The increase in the BHP region's value-added should, therefore, be considered a transfer from other areas in the Nation to the BHP region. The value-added resulting from the local sales to individuals employed in the construction or maintenance of the RPA from outside the region would also be a benefit to the region.

The most significant cause for a major difference in the net benefit of the RPA to the region and the Nation is that the cost of the facility will be borne by the users of VEPCO power and/or the owners of VEPCO stock and will thus be distributed throughout the state and the Nation with only an insignificant amount of the costs being incurred locally. The RPA would probably have a net positive impact on the area and that the RPA would result in a net transfer of "income" (broadly defined) from the rest of the Nation to the BHP region..

Consideration of the Incidence of Benefits
and Costs Associated with the
Recreational Ponds Area

The proposed RPA will serve to affect a net transfer of income from the users of VEPCO's electric power to the users of the RPA.^{10/} There may be seen to be two fundamental economic justifications for such a transfer. First, it may be desirable because it may compensate individuals adversely affected by the construction of the hydroelectric facility. In this sense, the RPA might provide compensation to those individuals who would have enjoyed project excluded recreational activities on or near the site of the hydroelectric facility. The construction of the hydroelectric facility will result in the estimated loss of between 900 and 1800 annual user-days annually of hunting and fishing. The RPA will supply approximately 12,000 user-days of fishing and no hunting user-days.^{11/} Since similar recreational activities will be substituted for that loss and the large increases in the level of fishing recreational activity appears to negate compensation or mitigation as a justification for the RPA.

Second, the proposed RPA may through the incidence of the associated benefits and costs serve to redistribute income in a manner which society would deem desirable. It is generally accepted that

^{10/} Income is defined broadly to include monetary income and the degree of access to activities which are not provided by the market.

^{11/} Federal Power Commission, op. cit.

transfers from high income to low income individuals are to some extent desirable.^{12/} However, it does not appear that the RPA will cause a net transfer of this type. The facility will be located in an area with low average income relative to the state, however, it is likely that users of the RPA will not represent a cross-section of the local population. There is generally a positive correlation between income levels and the use of such facilities and most of the visitors would be from outside the BHP region.

A positive correlation between income levels and electric power consumption would offset the effect of the above correlation, but it does appear that the construction of the RPA will transfer significant amounts of income from one group to another.

An income transfer affected through the construction of the RPA and the resultant imposition of higher utility rates might be undesirable because increasing the cost of electric power to the consumer above the cost of its provision would lead consumers to consume a "non-optimal" quantity of electric power and "other goods."^{13/} This would be the case if optimality is said to exist when the consumers of electric power equate at the margin the cost of a unit of electric power with its benefits to them. The imposition of higher rates might result in price exceeding marginal cost and thus the

^{12/} For example, the goals of the Appalachian Regional Development Act reflect this proposition.

^{13/} It is assumed that the cost of the RPA would be reflected in higher rates. It is possible that the cost could be "intra-marginal" and thus be imposed on VEPCO shareholders through a reduced dividend.

condition for optimality being violated. It is also possible, however, that VEPCO's rates are currently too low as they do not reflect external costs involved in the production of electric power.

The Averch-Johnson thesis which holds that utilities operating under rate of return regulation will not combine inputs in a cost minimizing fashion has been empirically verified in a study by Spann.^{14/} To the extent that it is applicable to VEPCO's operations, it becomes fruitless to speak of any positive or negative impact of a change in the rate structure.

Economic analysis of the type conducted does not indicate that there is any reason to construct the RPA, but neither does it lead to the conclusion that it is undesirable.

The Legality of the Recreation Ponds Area

The legal justification for the RPA depends upon the interpretation of the relevant portion of Title 18, Section 4.41, Exhibit R. The requirements of Exhibit R does not provide a justification for the RPA unless "project waters" are seen to include the streams upon which hydroelectric facilities are constructed.

The proposed RPA does not make available the impounded waters of the proposed hydroelectric facility, but rather, the waters of ponds constructed downstream from those facilities which are unre-

^{14/} Robert M. Spann, "Rate of Return, Regulation and Efficiency in Production: An Empirical Test of the Averch-Johnson Thesis," Bell Journal of Economics and Management Science, (Spring 1974), p. 38.

lated to any function of the hydroelectric facility. There does not seem to be any reasonable interpretation of "project waters" which would permit the waters of these ponds to be considered as such.

It is possible that the RPA was included in the project because the FPC reacted to a novel situation in a routinized fashion. According to officials of VEPCO, the FPC generally is known to desire that approximately one-half of one percent of the total project cost be for the construction of recreational facilities.^{15/} The specific percentage is not important, but it suggests that the FPC deals with the recreational aspect of hydroelectric projects in a routinized fashion (i.e., the application of the section containing the requirement for Exhibit R).

This manner of dealing with the general issue may result from the fact that the FPC usually is involved with license applications for hydroelectric projects which would contain sizable lakes with abundant recreational use potential. Recreation facilities around such lakes may have led to understandable and an efficient manner of dealing with the question of recreational facilities in that some approximate percentage of the total cost of the project be expended for recreational facilities. The FPC's experience has possibly indicated that this is a good approach and certainly one would expect some rough positive correlation between project cost and size and recreational potential.

^{15/} Statements by lawyers representing VEPCO at preliminary hearings on the license application at Warm Springs, Virginia.

A problem can be seen to arise, however, if such a "rule of thumb" is applied to situations quite different from those from which it evolved. The proposed pump storage facility has essentially no recreational potential if the sightseers are excluded. Thus, the FPC has, in effect, required that VEPCO create bodies of water with recreation use potential because the hydroelectric facility had none. If there is no potential recreational use of a proposed project, Exhibit R cannot be reasonable interpreted as requiring the construction of facilities such as the recreational ponds.

Summary

In this chapter, the recreational facilities included as part of the proposed hydroelectric facility were examined and analyzed from several perspectives. From a national accounting perspective, the Recreation Ponds Area was found to have a benefit-cost ratio greater than one if the high valuation of \$2.25 per user-day was used to estimate benefits. At lower valuation figures, the justification of the RPA on efficiency grounds becomes more questionable. The recreation area will have a positive impact on the study region's economy through increased economic activity and resident use, however, a complete assessment of local benefits and costs was not made. It appears that the incidence of the recreation facility's benefits and costs are such to result in an income transfer from electricity users (assuming the recreation facility's costs are reflected electric rates) to its recreation facility's uses. There is no economic rationale to justify this transfer nor to lead to the

conclusion that this transfer is undesirable. In terms of the "Code of Federal Regulations," there is some question as to whether the RPA is required in the hydroelectric facility because it is separate from the pump-storage reservoirs. However, it appears that the FPC has established a "rule of thumb" requiring recreational facilities in conjunction with such facilities.

CHAPTER V

SUMMARY AND CONCLUSIONS

The purpose of this study was to analyze the economic impacts of the proposed VEPCO pump-storage hydroelectric facility project to be located in Bath County, Virginia. The general objective of the analysis was to generate information and guidelines to improve the decision-making process in terms of present and potential proposals to construct similar facilities in other rural areas.

The more specific analytic objectives were:

1. To estimate impacts of the proposed hydroelectric generating facility upon the levels of economic activity and local government revenues and expenditures of Bath, Highland and Pocahontas Counties.
2. To estimate the benefits and costs associated with the proposed recreational facilities and to evaluate the justification for the inclusion of such recreational facilities in hydroelectric facilities.
3. To evaluate the procedures used by the FPC in considering license applications for hydroelectric facilities.

An interindustry model was constructed for the study region to estimate the economic impact of the project during a nine year period. This time period consisted of seven years of construction activity followed by completion of construction in the eighth year. In the eighth year, the facility would begin operation and long-term operation and maintenance activities would commence. In the ninth

year of analysis involves consideration of only the long-term effects of operation and maintenance and use of the recreational facilities associated with the project.

Changes in local government revenues and expenditures were estimated through consideration of tax revenue structures and demands for community services associated with population changes. The recreational facilities associated with the project were analyzed from an efficiency aspect through the use of benefit-cost analysis with further examination of the equity aspect in terms of the incidence of the benefits and costs associated with the recreational facilities.

Findings and Conclusions

The VEPCO project will result in a significant short term effect on the economies of Bath and Highland Counties. Large relative changes will occur during the peak construction period as a result of the expenditures of the project labor force. Retail sales will be approximately 50 percent and 90 percent higher than pre-project levels during the peak year of the construction period in Bath and Highland Counties, respectively. The sales of the service sector (not including the Homestead Resort) will increase by 80 percent in Bath County and by 100 percent in Highland County during the peak construction period. These large and rapid increases in sales will be matched by perceptuous declines following the peak construction period as the expenditures of permanent project employees and the

users of the adjacent recreational facilities will have only a minimal impact on the county economies.

It is important that the sellers of services and retail goods be aware of the extreme changes expected to occur in order that they may meet the increased demands in a manner which does not involve investments which cannot be justified on an accurate perception of long term sales levels.

Both counties should experience temporary full employment during the peak construction period due to employment opportunities available at the project and created by the expenditures of the project labor force. Unemployment will be expected to return to approximately the current levels in both counties at the close of the construction period and it is likely that those levels will be exceeded for a short period even if it is assumed that the temporary residents leave the area as they are laid off.

Employees, from the area, on the construction project should be aware that future opportunities for them to employ the skills acquired will probably not be available without moving from the area.

The effect of the VEPCO project on the governments of Bath and Highland Counties will be quite substantial as the expenditures by the Bath County government in the peak year of the construction will be approximately one million dollars above the current level while those of Highland County will increase approximately one-half million over that period if it is assumed that the quality of the services provided will remain constant. The increases in expenditures will not be matched by equivalent increases in the revenues of the

counties. The difference between increase in expenditures necessitated by the VEPCO project and increases in revenues resulting from the project will be as large as \$600,000 and \$275,000 in the peak year of construction in Bath and Highland Counties, respectively.

The ability of the counties to meet the fiscal needs resulting from the project will differ. When the project becomes operational, it is possible that Bath County will receive annual real estate tax revenues from the project equal to approximately twice its current total revenues. (There have been proposals that Bath County share the real estate tax revenues from the project with the state.) Highland County cannot expect a significant increase in tax revenues as a result of the project. Bath County's problem, if the real estate tax revenues are realized, will be in maintaining an adequate cash flow while Highland County simply does not have the resources to respond to the fiscal pressures which will occur.

Both Bath and Highland County have requested that VEPCO provide assistance in dealing with the impact of the project. The FPC is in the process of reviewing the license application and a decision regarding the assistance to be provided to the counties will presumably be included as a condition for the granting of the license. If it is desired that the project not result in reduced public service levels while not leading to the current residents of Bath and Highland Counties bearing the costs of the additional services required, it would appear that VEPCO should provide assistance to the counties. Such assistance is necessary because the means by which the counties raise

tax revenues does not permit the temporary residents associated with project construction to be taxed in order to pay for the services they will require. Bath County should either be advanced the funds necessary to maintain current service qualities without real increases in tax rates by the utility or it should be paid the interest on loans from other sources if they are available. Highland County should be paid the funds necessary to maintain current service qualities with tax rate increases if the above conditions are to be met.

Based on the above analysis, it may be generalized that the FPC should require that power companies bear the increased costs of local governments in similar cases, both in order to avoid transfers that would be considered undesirable and in order that the costs imposed by the construction of such facilities on the public sector will enter into the decision processes of utilities in selecting sites for such facilities.

Presumably if this were the case, the utilities would undertake to ascertain the public costs of such facilities and would tend to avoid those areas in which such facilities would be expected to have the greatest absolute impact. Then, and if it is assumed that the increase in value added due to the construction of such facilities is equal at all locations, the decisions by utilities concerning the building of such facilities will lead to the construction of facilities with the highest net benefits to society.

The FPC should also require that information be provided to the areas affected by such projects concerning the impact on the economy of the region. The provision of such information is of such

low cost that it would seem certain to in general to produce benefits, in terms of a more efficient response to the impact of such projects, in excess of its costs.

The FPC should examine recreational facilities proposed for such facilities to determine if they are justified economically. The FPC should apply the same standards to such facilities as do other federal agencies in evaluating facilities of this kind. Again, the costs of this information are insignificant compared to the potential savings. In the above analysis, a benefit-cost ratio of .914 and a recreation facility cost of \$1.5 million would result in a net welfare loss valued at approximately \$140,000.

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AN ECONOMIC ANALYSIS AND EVALUATION OF THE
IMPACT OF THE CONSTRUCTION AND OPERATION
OF A HYDROELECTRIC FACILITY IN A
RURAL AREA OF VIRGINIA

by

William B. Anderson

(ABSTRACT)

The construction and operation of the VEPCO pump-storage hydroelectric facility will have a significant impact on Bath and Highland Counties, Virginia. Adjustments to this impact, both by the private and the public sectors, will depend upon accurate perceptions of the future. The purpose of this study was to estimate the changes in the level of economic activity and in local government revenues and expenditures which would occur as a result of the VEPCO project.

Knowledge of the manner in which the area economy functions is necessary in order to estimate the changes resulting from the project. An interindustry model for the area economy was constructed employing the theoretical framework of the open-static Leontief input-output system. The data to construct the model were obtained from primary and secondary sources and through the application of technical coefficients developed in a study of a similar, adjacent area. The interindustry model provided the means by which the im-

fact of the increased expenditures in the area, as a result of the project, was determined. The effect of the expenditures on the sales levels of the different sectors of the area economy, and of Bath and Highland Counties specifically was determined for each of the nine years over which the impact of the project will be felt.

The impact of the project on the demands for local government services and upon the revenues which the governments will receive was determined through an analysis of expected population patterns, current service qualities and costs, expected revenues generated locally and revenues received from state sources which will vary with population. This analysis provided the basis for estimating the net fiscal effect of the project on the governments of Bath and Highland Counties.

Certain portions of the recreational facilities proposed as part of the project were analyzed employing benefit-cost analysis, and it was determined that those facilities could not be generally justified from an economic efficiency perspective, however, rational equity considerations may provide a justification