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Regional Economic Impacts of Changes in Electricity Rates Resulting from Western Area Power Administration's Power Marketing Alternatives

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FOREWORD

This report is one of a series of technical memorandums prepared to support an environmental impact statement (EIS) on power marketing prepared by Argonne National Laboratory for the U.S. Department of Energy's Western Area Power Administration (Western). Western markets electricity produced at hydroelectric facilities operated by the Bureau of Reclamation. The facilities are known collectively as the Salt Lake City Area Integrated Projects (SLCA/IP) and include dams equipped for power generation on the Colorado, Green, Gunnison, and Rio Grande rivers and on Plateau Creek in the states of Arizona, Colorado, New Mexico, Utah, and Wyoming.

Western proposes to establish a level of commitment (sales) of long-term firm electrical capacity and energy from the SLCA/IP hydroelectric power plants; the impacts of this proposed action are evaluated in the EIS. Of the SLCA/IP facilities, only the Glen Canyon Dam, Flaming Gorge Dam, and Aspinall Unit (which includes Blue Mesa, Morrow Point, and Crystal dams) are influenced by Western's power scheduling and transmission decisions. For this reason, the impacts of hydropower operations at these three facilities were examined in the EIS.

The technical memorandums present detailed findings of studies conducted by Argonne National Laboratory specifically for the EIS. These studies are summarized in the EIS, and the results were used to assess environmental impacts related to alternative commitment levels. Technical memorandums were prepared on a number of socioeconomic and natural resource topics. Staff members of Argonne National Laboratory's Decision and Information Sciences Division and Environmental Assessment Division prepared these technical memorandums and the EIS as part of a joint effort managed by the Environmental Assessment Division.

CONTENTS

CONTENTS

TABLES

TABLES

FIGURES

REGIONAL ECONOMIC IMPACTS OF CHANGES IN ELECTRICITY RATES RESULTING FROM WESTERN AREA POWER ADMINISTRATION'S POWER MARKETING ALTERNATIVES

by

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ABSTRACT

This technical memorandum describes an analysis of regional economic impacts resulting from changes in retail electricity rates due to six power marketing programs proposed by Western Area Power Administration (Western). Regional economic impacts of changes in rates are estimated in terms of five key regional economic variables: population, gross regional product, disposable income, employment, and household income. The REMI (Regional Impact Models, Inc.) and IMPLAN (Impact Analysis for Planning) models simulate economic impacts in nine subregions in the area in which Western power is sold for the years 1993, 2000, and 2008. Estimates show that impacts on aggregate economic activity in any of the subregions or years would be minimal for three reasons. First, the utilities that buy power from Western sell only a relatively small proportion of the total electricity sold in any of the subregions. Second, reliance of Western customers on Western power is fairly low in each subregion. Finally, electricity is not a significant input cost for any industry or for households in any subregion.

SUMMARY

This technical memorandum describes the analysis of regional economic impacts of changes in electricity rates that result from existing and possible new Western Area Power Administration (Western) marketing alternatives. Each commitment-level alternative represents a possible dam operation and power generation combination. The analysis measures the impacts of each commitment-level alternative in each of nine subregions within the affected area. These subregions are defined on the basis of similarities in economic structure; there are six metropolitan subregions and three primarily rural subregions. The analysis uses information on changes in retail electricity prices and expenditures on electricity at the utility level. These are aggregated to determine changes in prices and expenditures by customer class (industrial, commercial, and residential) for each of the nine subregions.

The impacts of changes in electricity rates arising from commitment-level alternatives are measured in terms of five key regional variables: population, gross regional product (GRP), disposable income, employment, and household income groups. Estimates for each commitment-level alternative in each subregion are provided for the base year (1993) and forecasted for each year through 2008. In estimating regional impacts, the effects of changes in electricity rates on the cost of doing business for 48 industrial and commercial sectors and the subsequent impacts on the economy of each subregion are considered, together with the impacts of changes in electricity expenditures on household spending and the subsequent impacts on the economy of each subregion. Also considered is the impact of each commitment-level alternative on household income groups in each of the subregions.

The analysis uses the Regional Economic Models, Inc. (REMI), modeling framework to estimate the impacts of the various commitment-level alternatives on population, GRP, disposable income, and employment, and it uses a modified version of the Impact Analysis for Planning (IMPLAN) modeling framework to measure the impacts of Western's programs on household income groups. The REMI modeling system combines information on the input-output structure of each subregional economy with econometric estimates of labor and capital demand, population and labor supply, market shares and wages, and prices and profits. The resulting modeling framework provides a partial equilibrium approach to the modeling of impacts that integrates all the key features of the economy of each subregion. Input-output and econometric frameworks are commonly used to estimate the regional economic impacts of given changes in the economy of an area, and both have been used to produce impact information for a range of policy programs and industrial development strategies. The IMPLAN modeling system is combined with disaggregated information on the household and consumption sectors of the input-output table to measure the impacts on household income groups. The modified model contains a series of income accounts showing information on the sectors and income brackets of recipients and consumers.

Estimates show that over the forecast period, changes in Western's power commitments have a minimal impact on aggregate economic activity in each of the nine subregions. Examination of the impacts of increases in electricity rates on income, GRP, and employment shows that changes in these indicators of economic activity do not exceed 0.25% for any of the commitment-level alternatives or supply options in any of the subregions for any of the years in the forecast period. Even though rate increases arising from the commitment-level alternatives and supply options increase the cost of doing business in each of the subregions and can lead to the outward migration of population and business activity, these effects are small in magnitude. Changes in power commitment-levels also have a very small impact on households with annual incomes of less than $30,000.

There are differences in the impacts of changes in electricity rates across the nine subregions. Impacts are largest in the Rocky Mountain and Colorado Metropolitan Subregions for most variables in each commitment-level alternative. Both the Nevada Metropolitan and the Wyoming Metropolitan Subregions fail to show any measurable impacts from any of the alternatives or supply options for the four variables considered.

The impacts of changes in retail rates resulting from changes in power marketing programs are minimal at the regional level for three reasons. First, in each subregion, the proportion of total electricity sold by utilities buying power from Western is relatively small when compared with the amount sold by public utilities. The level of reliance of Western customers on Western power is also relatively low. The small proportion of sales and low level of reliance mean that even though there are large changes in the rates charged by some of Western's customer utilities, the impact on the cost of electricity in each subregion is small. Second, electricity is not a significant input cost for most sectors in any subregion. Therefore, changes in electricity rates do not significantly affect the cost of doing business in any subregion. Finally, electricity costs are not a significant element of household spending for the majority of households in each subregion, which means that changes in electricity rates do not significantly affect the overall level of household spending or spending by lower-income households.

.1 INTRODUCTION AND BACKGROUND

The Salt Lake City Area Office of Western Area Power Administration (Western) developed marketing strategies and allocation criteria during the 1980s for the purpose of integrating the power generation operations and contractual obligations of the four main hydroelectric projects under Western control. The resulting post-1989 marketing and allocation criteria established terms under which Western would allocate long-term firm sales of electricity to power customers. These marketing criteria have led to a number of legal, environmental, and political concerns, resulting in the development of a series of power generation and dam operation alternatives. Each alternative represents a combination of possible dam operation and power generation options Western is considering to increase power revenues while continuing commitments made to preferred power customers.

The development of these alternatives has led to concern that changes in electricity rates that would result from changes in operations mandated by each alternative might have significant effects on the economy of the region in which Western sells power. This region includes five entire states and parts of seven others and contains a variety of economic activities located in rural, semirural, and urban areas. Changes in electricity rates in such a large region would therefore have the potential to affect a variety of different economic activities and occupations.

1.1 OBJECTIVES OF THE REGIONAL ECONOMIC ANALYSIS

To fully assess the magnitude of the regional economic impacts of changes in electricity rates, the analysis of regional impacts included in the Western Electric Power Marketing Environmental Impact Statement (EIS) focused on the impacts resulting from existing power marketing programs and six additional commitment-level alternatives proposed by Western. The objective of the regional impact analysis was to provide information in the following areas:

- Estimates of the economic baseline in the region in which Western power is sold,

- The regional economic impact of existing Western power marketing programs,

- The regional economic impact of a range of possible changes in power marketing programs, and

- Forecasts of the baseline and the regional impacts of changes in power marketing programs.

A number of conceptual issues arose in the development of a methodology for the estimation of impacts in the EIS: the scope of the impacts to be measured, the choice of

modeling framework for the measurement of impacts, and the geographic scale at which to measure the impacts.

1.2 SCOPE OF THE ANALYSIS

Changes in electricity prices have the potential to affect regional economic activity through their impact on the cost of doing business for commercial and industrial customers and through their impact on household spending power. Increases in the cost of doing business mean that in the short term, the level of economic activity in each subregion will be reduced, and both consumers and businesses will switch to goods with lower production costs from outside the study region. In the long term, changes in rates could lead households and businesses to relocate to areas with lower rates outside the study region. The likelihood that the number of relocations will be significant depends partly on the size of the increase in electricity prices at the subregional level compared with prices in other regions. However, industries that consume significant amounts of electricity also tend to be more capital-intensive than industries in which electricity is less important, and they tend to have high relocation costs. Changes in electricity rates would therefore need to be large enough to offset relocation costs for these industries.

The regional impacts of changes in electricity rates in the area in which Western power is sold were estimated by examining the impacts of changes in (1) the cost of doing business, (2) household expenditures, and (3) annual low-income-household incomes. These impacts were estimated for each of the nine subregions used in the analysis. Additional analysis for an extreme case estimated the impacts of changes in rates in two counties in New Mexico that have high reliance on Western power combined with large changes in retail rates under each of the alternatives.

The regional economic impact sections of the EIS estimate the impact of present operations and a variety of changes in hydropower operations and marketing conditions on the economy of the area in which Western sells power. This technical memorandum provides detailed information on the methodologies used to estimate the magnitude of possible impacts in support of material included in the EIS. Regional economic impacts of changes in electricity prices are estimated for a no-action alternative and six commitment-level alternatives that reflect a range of possible power generation combinations.

Changes in hydropower marketing programs will also result in changes in the generation, sale, and trading of electricity in the economy of each of the nine subregions. These adjustments will produce secondary impacts in each subregion as the electricity sector makes adjustments to losses in power previously obtained from Western. These secondary impacts will primarily affect non-Western (investor-owned utility [IOU]) generation and will come in the form of changes in demand for the production of fossil fuel, transportation, and capital equipment as generation and transmission capacity is added. The analysis undertaken for the EIS and the discussion in this technical memorandum do not include an assessment of secondary impacts in the estimation of the magnitude of impacts from each commitment-level alternative and supply option. The assessment was not included because three items were not known when the analysis was undertaken: the precise location of

additional generation and transmission capacity to offset any shortfalls from Western, the nature of the technology to be used in any new capacity, and the timing of the required new construction activities. However, because the impacts of constructing new generation and transmission technology will probably offset the impacts of higher retail rates in at least some of the subregions used in the analysis, the regional economic impacts of each commitment-level alternative and supply option estimated in the analysis are somewhat conservative.

In addition, the cumulative impacts of each of the alternatives and supply option combinations on the economies of the areas in which Western power is sold are not considered separately. Changes in regional economic and demographic variables occurring in the short and long term as a result of changes in electricity rates with each commitment-level alternative and supply option were included in the analysis, with results presented for the three years 1993, 2000, and 2008. No separate presentation is therefore made of the cumulative impacts of possible changes in power commitment levels and dam operational scenarios.

1.3 OVERVIEW OF METHODS

Changes in electricity rates in each of these areas will have both direct and secondary impacts. The direct impacts of changes in electricity rates occur as industries cut back production and households change spending behavior. Secondary impacts occur as industries supplying those that are directly affected adjust their production and spending. The full and accurate measurement of the impacts of changes in electricity prices would include each of these areas of impact. Input-output-based economic models provide the most comprehensive means of measuring impacts due to changes in the cost of doing business, household expenditures, and income distribution because of their highly disaggregated nature. Impacts include direct and secondary impacts for a wide range of industries or groups of industries.

Input-output models rely on detailed accounts of the purchases and sales by each sector of any given economy. The accounts include (1) the industry source and destination of intermediate demand, or the goods and services required to produce a final good or service; (2) final demand by industry, including consumption, inventory accumulation, government purchases, investment, and exports; and (3) final payments by industry, including inventory depletion, imports, transfer payments, and depreciation. A number of simplifying assumptions transform the accounting system into a model that will provide accurate estimates of changes in output needed throughout the entire economy to meet a new level of demand for the output of any given industry. Input-output analysis is one of the most commonly used approaches to estimating the regional economic impacts of given changes in the economy of an area, and it has been used to produce impact information for a range of policy programs and industrial development strategies.

The analysis of regional economic impacts in the Western EIS uses the Regional Economic Models, Inc. (REMI), modeling framework to estimate the impacts of changes in

electricity prices on four key regional variables: population, gross regional product (GRP), disposable income, and employment. The analysis was undertaken for each of nine subregions within the area in which Western power is sold (see Section 1.4). The REMI modeling system combines information on the input-output structure of the economy with econometric estimates of labor and capital demand, population and labor supply, market shares and wages, and prices and profits. The resulting modeling framework provides a partial equilibrium approach to the modeling of impacts that integrates all the key features of the economy. Inputs used for the model include changes in regional electricity rates and changes in expenditures on electricity by customer class (residential, commercial, and industrial). The analysis estimates the magnitude of the consequent increase in the cost of doing business and the impacts of changes in household expenditures on the remainder of the economy of each subregion. Estimates are provided for the base year (1993) for each commitment-level alternative in each subregion and forecasted for each year through 2008.

The analysis of regional economic impacts that uses the REMI modeling framework assesses impacts that would occur in nine subregions, each consisting of counties receiving Western power. The analysis essentially averages the impact of each commitment-level alternative and supply option across all utilities in these subregions. The three rural subregions are geographically large and contain a number of Western customer utility service territories. To provide an indication of the magnitude of impacts of each commitment-level alternative within an individual utility service territory, additional analysis was also performed at the county level. Two counties were chosen from one rural subregion (1) that contains Western customer utilities with high reliance on Western power and (2) in which a high proportion of power sold in each county comes from Western customer utilities. The impacts of each alternative were modeled by estimating the effects of changes in total electricity expenditures in each county, as opposed to measuring the effects of changes in electricity prices used in the measurement of impacts at the subregional level.

The impacts of changes in electricity rates in the two counties were estimated by using the Impacts Analysis for Planning (IMPLAN) modeling system and were measured in terms of changes in output, employment, and income. The IMPLAN model is an input-output modeling system that combines information on sales and purchases between different industries with information on sales from industries to final demand in a partial equilibrium framework. Although the IMPLAN modeling framework is not as comprehensive as the REMI system, it is a reliable and widely accepted means of estimating the impacts of specific economic policy initiatives.

Also included are the impacts of each commitment-level alternative on household income groups. The analysis uses a modified version of the IMPLAN modeling framework to measure the impacts of Western's programs on changes in the distribution of income in household income groups. The IMPLAN modeling system was combined with disaggregated information on the household and consumption sectors of the input-output table to measure household income impacts. The modified model contains a series of income accounts showing information on the sectors and income brackets of recipients and consumers. The model uses

information on changes in revenues derived from the sale of electricity associated with each commitment-level alternative.

The analysis uses data on the impacts of rate changes associated with each of the alternatives for individual Western customer utilities — specifically, changes in residential expenditures on electricity and in commercial and industrial retail rates. These are aggregated to provide data on changes in prices and expenditures by customer class for each of the nine subregions. Data on changes in residential expenditures on electricity at the subregional level and changes in electricity rates are used as inputs to the REMI modeling system to provide an estimate of the magnitude of the impacts of each alternative in each subregion. Data on changes in total expenditures on electricity are used as input to the IMPLAN modeling system to measure impacts in the high-reliance counties and impacts on lower-income households in each subregion.

1.4 CHOICE OF GEOGRAPHIC SCALE USED IN THE ANALYSIS

The analysis measures the impacts of each commitment-level alternative in each of nine subregions within the affected area. These subregions are defined on the basis of similarities in economic structure. There are six metropolitan subregions (Arizona Metropolitan, Colorado Metropolitan, Nevada Metropolitan, New Mexico Metropolitan, Utah Metropolitan, and Wyoming Metropolitan) and three primarily rural subregions (High Plains, Rocky Mountains, and Great Basin). (See Table A.1 for a list of the counties included in each subregion.)

A larger number of regions might have been chosen to provide a more detailed analysis of the impacts of changes in power marketing programs on individual sectors at a more specific geographical level. However, the level of diversification within the majority of the counties included in each metropolitan subregion meant that it was not likely that the impact of any industries suffering significant adverse effects from changes in rates would have any effect on overall regional economic well-being. Similarities in economic base across counties within each of the three rural subregions meant that the impacts of changes in electricity rates would not be obscured by the overall size of these subregions. Any significant impacts to specific industries, such as agriculture, due to changes in electricity rates would be measurable, even given the size of the regions, because of the importance of employment and output from these activities in each of the three regions.

Because each of the 195 counties used to construct the nine subregions used in the analysis receives power from Western, the effect of aggregating the impacts of each alternative and supply option from the county level (where impacts on individual utility service districts could be measured) to the subregional level is to average the impact of each alternative and supply option across all utilities in each of the subregions. To examine the impacts of each alternative and supply option at the local level, however, additional analysis was undertaken for two counties in New Mexico that contain Western customer utilities with high reliance on Western power and in which a high proportion of power sold in each county comes from Western customer utilities. As a result of the alternatives and supply options,

end-use customers in these counties would experience changes in retail rates that would be among the largest across all the counties receiving Western power. The results of this analysis, therefore, provide information on the impacts of power marketing alternatives on the economy of a local area in an extreme case.

Agriculture provides a significant contribution to total income in the numerous counties in the six states of Arizona, Colorado, Nevada, New Mexico, Utah, and Wyoming. The majority of crops in these states are irrigated with electrically pumped groundwater, so changes in electricity rates could significantly increase agricultural production costs. The EIS assessed the impacts of changes in retail rates on agriculture in each of these states and in five groups of counties in Colorado and Utah, which were chosen on the basis of the share of county income coming from agricultural sources and the share of power sold by utilities serving these counties coming from Western. Sector-specific and county-specific analyses of the impacts of changes in retail rates were therefore not included in the analysis of regional impacts. A full description of data, methods, and findings in the analysis of agricultural impacts can be found in Edwards et al. (1995).

This technical memorandum describes the analysis of regional economic impacts of changes in electricity rates resulting from existing and possible new Western marketing programs. The report is in five parts. This first section describes the objectives and scope of the analysis of regional impacts of changes in electricity rates, and it provides an overview of the methods used in the analysis. Section 2 briefly describes existing and planned power marketing programs as well as the changes in wholesale rates resulting from each; it summarizes the impacts of commitment-level alternatives on nine subregions within the area in which Western power is sold, and it discusses three factors that limit the regional impact of changes in rates at the utility level. Section 3 describes the nine subregions in which Western power is sold in terms of population, GRP, employment, disposable income, and annual household income. Section 4 discusses the scope of the analysis and the methods and data used to estimate the regional impacts of changes in power marketing programs, including the procedures used to convert retail price changes at the utility level to the subregional level. Section 5 provides details on the regional economic impacts of the various commitment-level alternatives in terms of population, GRP, employment, disposable income, and household income group. This discussion is followed by a summary and overview of findings, including implications for Western power marketing programs.

2 REGIONAL IMPACT OF CHANGES IN WESTERN'S POWER MARKETING PROGRAMS

2.1 DESCRIPTION OF WESTERN'S ELECTRIC POWER MARKETING PROGRAMS

Western's Salt Lake City Area Office developed marketing strategies and allocation criteria during the 1980s for the purpose of integrating power generation operations and contractual obligations of the four main hydroelectric projects under Western control. The resulting post-1989 marketing and allocation criteria established terms under which Western would allocate long-term firm sales of electricity to power customers. Because the development of the post-1989 marketing criteria has led to a number of legal, environmental, and political concerns, a number of power generation and dam operation alternatives have also been developed. Each alternative represents a combination of possible dam operation and power generation options Western is considering to increase power revenues while continuing commitments made to power customers.

The alternatives under consideration include a no-action alternative, representing a continuation of the pre-1989 power marketing criteria; an alternative that reflects the post-1989 marketing plan; and five additional commitment-level alternatives. Each alternative represents a combination of different power supply and dam operation options. Table 1 outlines the main characteristics of each commitment-level alternative. Power supply options include capacity commitments ranging from 550 to 1,450 megawatts (MW) and energy commitments ranging from 3,300 to 6,156 gigawatt-hours (GWh). Dam operation scenarios include full flexibility and low flexibility options, in which water releases are varied, and a steady flow option. To meet the power commitments under some alternatives, power purchases are required. Other alternatives produce excess sales.

Variations in wholesale rates for power sold under each alternative reflect the different energy and capacity commitments, dam operation scenarios, and power sales and purchases associated with each alternative. The full flexibility option with the no-action alternative represents the base-case scenario. The combined rate charged for energy and capacity for long-term firm sale customers under the present marketing strategy and the six additional proposed marketing alternatives are compared with the base case in Table 1. As the table shows, combined rates vary with supply option, capacity, and energy commitment. Combined rates for power from the three supply options are lowest for supply option A, ranging from 14.36 mills/kWh under alternative 4 to 22.10 mills/kWh under alternative 1. For supply option B, rates range from 17.50 mills/kWh under alternative 4 to 27.26 mills/kWh under alternative 5. For supply option C, alternative 4 has the lowest rate, at 27.46 mills/kWh, and alternative 1 has the highest, at 41.40 mills/kWh.

Under alternatives 2A, 3A, 4A, 4B, 5A, and 6A, the combined energy and capacity charge is lower than the rate charged under the baseline (the pre-1989 marketing criteria). If power were to be marketed under any of these alternatives, wholesale rates

TABLE 1 Electric Power Marketing EIS Commitment-Level Alternatives and Supply Options

Alternative	Description	Supply Option	Dam Operation	Capacity Commitment (MW)	Energy Commitment (GWh)
No Action	Moderate capacity and high energy (the 1978 marketing program commitment-level)	A B C	Full flexibility Low fluctuation Steady flow	1,291	5,700
1	High capacity and high energy (post-1989 commitment-level)	A B C	Full flexibility Low fluctuation Steady flow	1,449	6,156
2	High capacity and low energy	A B C	Full flexibility Low fluctuation Steady flow	1,450	3,300
3	Moderate capacity and moderate energy	A B C	Full flexibility Low fluctuation Steady flow	1,225	4,000
4	Low capacity and low energy	A B C	Full flexibility Low fluctuation Steady flow	550	3,300
5	Low capacity and high energy	A B C	Full flexibility Low fluctuation Steady flow	625	5,475
6	Moderate capacity and moderate energy	A B C	Full flexibility Low fluctuation Steady flow	1,000	4,750

charged to utilities would be lower than they are under the present plan. As is seen in Sections 2.2 and 5, lower rates at the wholesale level charged to preferred utility customers translate into positive economic impacts at the regional level in a number of regions in which Western power is sold.

Bodmer et al. (1995) documents the impact of changes in wholesale power rates charged to preferred customer utilities on financial viability and rates charged to end-user customers. For a number of high-reliance utilities, changes in rates under a number of alternatives translate into significant changes in retail rates charged to local power consumers. At the regional level, however, changes in retail rates charged by Western customer utilities do not significantly affect the regions in which Western power is sold. Three factors influence the magnitude of the regional impacts of changes in wholesale rates charged to utility customers: (1) the importance of Western power in each of the subregions, (2) the composition of sales by customer class, and (3) the importance of electricity as an

industrial factor input. The next two sections discuss the impact of these factors and summarize the regional impacts of changes in retail rates from each power marketing alternative.

2.2 FACTORS THAT DETERMINE THE MAGNITUDE OF THE REGIONAL ECONOMIC IMPACTS OF POWER MARKETING PROGRAMS

The regional impacts of changes in commitment-level alternatives are relatively small in each of the subregions. Three factors influence the manner in which each commitment-level alternative and supply option affects the economy of each subregion in which Western power is sold:

- The importance of Western power in each subregion (reliance of Western customer utilities on Western power and power sales by Western customer utilities),

- The composition of sales by customer class (residential, commercial, and industrial) by Western customer utilities, and

- The importance of electricity as a industrial factor input in the subregions in which Western customer utilities are located.

Other factors also influence the impact of changes in hydropower operations in each subregion. Differences in energy and capacity commitments among the alternatives, changes in dam operations, and changes in the allocation of power also affect the regions in which Western power is sold. However, because the purpose of the regional analysis of changes in Western power marketing alternatives is to assess the impacts of changes in electricity rates for power sold to final customers by individual customer utilities, the effect of these factors on the economy of each subregion are not explicitly considered. The impacts of these factors in each subregion are modeled indirectly, through changes in retail rates charged by individual customer utilities (since they reflect changes in wholesale power rates charged by Western to customer utilities and changes in Western power allocations). The impacts take into account the impacts on subregional prices and expenditures on electricity purchases and additions to capacity from non-Western sources that are needed to meet shortfalls from Western hydropower generation that occur under most of the alternatives.

While it may therefore be possible to determine the impact of one or more of these factors on the results of the estimation of regional impacts, the discussion of impacts is limited to the impacts of changes in retail rates charged by customer utilities in each of the subregions on the level of regional activity. The regional impact analysis therefore considers only the impacts of changes in the overall level of retail rates changed to industrial and commercial customers and of changes in electricity expenditures in each subregion.

2.2.1 Importance of Regional Sales of Western Power

The level of reliance of Western customer utilities on Western power is an important component of regional variation in the economic impact of each alternative. Changes in the wholesale rates charged by Western to its customer utilities have significant impacts in each subregion if sales of Western power constitute a significant proportion of sales by individual customer utilities. Table 2 shows the reliance on Western power of all Western customer utilities for each of the nine subregions for the no-action alternative and alternatives 2C, 4C, and 5C for the year 2000. The table shows that the level of reliance of Western customer utilities on Western power is relatively high in a number of subregions, particularly the Utah Metropolitan Subregion for the no-action alternative (43.0% of customer utility sales) and alternative 5 (37.6% of customer utility sales). In the Wyoming Metropolitan Subregion, the reliance level is 26.8% for the no-action alternative and 25.2% for alternative 5. Reliance levels elsewhere are typically less than 15% of customer utility sales.

Although Western customer utilities rely fairly heavily on Western power in a number of subregions, the importance of power sales by Western customer utilities with respect to total power sales in each subregion may have a greater influence on changes in regional economic activity. Table 3 shows the total regional power sales and the proportion of power sales in each subregion made up by sales of Western power by Western customer utilities (i.e., not total sales by Western customers) for the no-action alternative and alternatives 2C, 4C, and 5C for the year 2000. The table essentially shows the reliance of each subregion on Western power. Shown in the table are power sales under the no-action alternative and alternatives 2, 4, and 5 (supply option C) for the year 2000. The proportion of total power sales originating from Western is less than 10% of total power sales in each of subregions. Sales exceed 5% only in the Colorado Metropolitan High Plains, Rocky Mountain, and Great Basin Subregions under the no-action alternative and alternative 5. In the Arizona Metropolitan and Wyoming Metropolitan Subregions, power sales are equal to or less than 1% of total region sales of Western power for each of the four alternatives examined.

2.2.2 Importance of Western Power Sales by Customer Class

Another factor that influences the magnitude of the impacts of changes in hydropower operations is the composition of sales to each of the three customer classes by utilities that receive power from Western. The regional economic impacts of changes in rates charged for electricity sold by Western customer utilities to residential customers will be significantly different from the impacts of changes in rates charged to industrial and commercial customers. Table 4 shows that although sales by Western customer utilities to residential, commercial, and industrial customers for the entire region in which Western power is sold are relatively low, there are variations in each class for each subregion. Sales are shown for alternative 5C for the year 2000; residential sales are in dollars, and commercial and industrial sales are in gigawatt-hours. Residential sales by Western customers are largest in the Rocky Mountain and Great Basin Subregions, where sales by

TABLE 2 Reliance (GWh) on Western Power by Western Customers, by Alternative: 2000

Subregion	Sales[a]	NA-C	2C	4C	5C
1	By all Western customers	18,351.67	18,309.49	18,301.23	18,325.19
Ariz.	Of Western power	418.03	347.02	347.02	390.79
Met.	Western (% of total)	2.28	1.90	1.90	2.13
2	By all Western customers	8,106.46	8,243.07	8,211.68	8013.60
Colo.	Of Western power	1,188.28	661.92	661.61	1043.91
Met.	Western (% of total)	14.66	8.03	8.06	13.03
3	By all Western customers	814.97	814.97	814.97	814.97
Nev.	Of Western power	123.68	63.21	63.21	103.99
Met.	Western (% of total)	15.18	7.76	7.76	12.76
4	By all Western customers	844.66	820.52	814.82	908.62
N.M.	Of Western power	144.70	95.49	89.85	204.70
Met.	Western (% of total)	17.13	11.64	11.03	22.53
5	By all Western customers	1,384.37	1,332.15	1,393.25	1,380.80
Utah	Of Western power	595.34	321.74	321.19	518.47
Met.	Western (% of total)	43.00	24.15	23.05	37.55
6	By all Western customers	16.25	16.04	16.20	15.85
Wyo.	Of Western power	4.35	2.31	2.30	3.99
Met.	Western (% of total)	26.80	14.38	14.22	25.21
7	By all Western customers	3,604.04	3,597.63	3,598.06	3,545.78
High	Of Western power	650.20	356.41	354.26	592.36
Plains	Western (% of total)	18.04	9.91	9.85	16.71
8	By all Western customers	6,527.50	6,556.38	6,526.61	6,292.98
Rocky	Of Western power	820.86	492.89	491.38	810.82
Mt.	Western (% of total)	12.58	7.52	7.53	12.88
9	By all Western customers	5,830.22	5,856.06	5,774.74	5,623.76
Great	Of Western power	870.75	518.30	512.71	834.54
Basin	Western (% of total)	14.94	8.85	8.88	14.84

[a] Sales by all Western customers are total power sales by all Western customer utilities in the subregion. Sales of Western power are sales of only Western power by all Western customer utilities in the subregion.

TABLE 3 Power Sales (GWh) by All Utilities and by Western Customers, by Alternative: 2000

Subregion[a]	Sales[a]	NA-C	2C	4C	5C
1	By all utilities	41,700.03	41,657.85	41,649.59	41,673.55
Ariz.	Of Western power	418.03	347.02	347.02	390.79
Met.	Western (% of total)	1.00	0.83	0.83	0.94
2	By all utilities	20,231.06	20,367.67	20,336.28	20,138.20
Colo.	Of Western power	1,188.28	661.93	661.61	1,043.91
Met.	Western (% of total)	5.87	3.25	3.25	5.18
3	By all utilities	10,298.67	10,298.67	10,298.67	10,298.67
Nev.	Of Western power	123.68	63.21	63.21	103.99
Met.	Western (% of total)	1.20	0.61	0.61	1.01
4	By all utilities	7,485.05	7,460.91	7,455.22	7,549.01
N.M.	Of Western power	144.70	95.49	89.85	204.70
Met.	Western (% of total)	1.93	1.28	1.21	2.71
5	By all utilities	16,058.21	16,005.99	16,067.09	16,054.64
Utah	Of Western power	595.34	321.74	321.19	518.47
Met.	Western (% of total)	3.71	2.01	2.00	3.23
6	By all utilities	1,337.60	1,337.40	1,337.56	1,337.20
Wyo.	Of Western power	4.35	2.31	2.30	3.99
Met.	Western (% of total)	0.33	0.17	0.17	0.30
7	By all utilities	11,265.64	11,259.23	11,259.66	11,207.38
High	Of Western power	650.20	356.41	354.26	592.36
Plains	Western (% of total)	5.77	3.17	3.15	5.29
8	By all utilities	12,732.72	12,761.60	12,731.84	12,498.20
Rocky	Of Western power	820.86	492.89	491.38	810.82
Mt.	Western (% of total)	6.45	3.86	3.86	6.49
9	By all utilities	14,483.01	14,508.85	14,427.53	14,276.55
Great	Of Western power	870.76	518.30	512.71	834.54
Basin	Western (% of total)	6.01	3.57	3.55	5.85

[a] Sales by all utilities are total power sales by all utilities in the subregion. Sales of Western power are sales of only Western power (not total sales) by all Western customer utilities in the subregion.

TABLE 4 Power Sales by Customer Class for Alternative 5C: 2000

Subregion	Sales	Residential (1992 $)	Commercial (GWh)	Industrial (GWh)
1	By all utilities	15,865.83	14,878.76	9,727.14
Ariz.	Of Western power	133.11	120.94	75.64
Met.	Western (% of total)	0.84	0.81	0.78
2	By all utilities	7,428.21	9,486.69	1,699.00
Colo.	Of Western power	358.12	294.30	288.96
Met.	Western (% of total)	4.82	3.10	17.01
3	By all utilities	5,222.26	2,309.41	2,767.00
Nev.	Of Western power	0.00	3.27	100.72
Met.	Western (% of total)	0.00	0.14	3.64
4	By all utilities	1,599.71	2,804.95	2,592.21
N.M.	Of Western power	21.25	13.84	155.86
Met.	Western (% of total)	1.33	0.49	6.01
5	By all utilities	3,817.08	3,848.60	8,386.25
Utah	Of Western power	164.27	215.03	136.63
Met.	Western (% of total)	4.30	5.59	1.63
6	By all utilities	243.00	511.89	582.02
Wyo.	Of Western power	0.09	3.83	0.00
Met.	Western (% of total)	0.04	0.75	0.00
7	By all utilities	3,466.25	2,855.75	4,480.93
High	Of Western power	178.51	110.84	214.26
Plains	Western (% of total)	5.15	3.88	4.78
8	By all utilities	3,171.79	3,002.57	6,322.30
Rocky	Of Western power	227.18	237.27	323.70
Mt.	Western (% of total)	7.16	7.90	5.12
9	By all utilities	5,692.97	4,132.05	4,435.54
Great	Of Western power	406.11	273.99	158.84
Basin	Western (% of total)	7.13	6.63	3.58

these utilities constitute roughly 7% of total subregional residential sales. Sales by Western customers to commercial customers are largest in the Rocky Mountain Subregion at 7.9%, while there are smaller shares of subregional sales to commercial customers in the Great Basin and Utah Metropolitan Subregions. Sales to industrial customers in the Colorado Metropolitan Subregion, at about 17%, dominate sales by Western customer utilities in this customer class; sales elsewhere exceed 5% only in the New Mexico Metropolitan Subregion.

2.2.3 Importance of Electricity as a Factor Input

A third factor that influences regional variation in the impact of each alternative is the importance of electricity as a factor input in each of the subregions in which Western customer utilities are located. Each of the nine subregions has an economic structure based on a series of industries that distinguish each subregion from the remainder of the area in which Western power is sold. Therefore, there are variations in the importance of electricity as a factor input to industries in each region and variations in the proportion of household income spent on electricity. Changes in electricity rates will affect each region differently, depending on the economic structure. Table 5 shows the importance of electricity as a factor input to regional industries in the six metropolitan regions served by Western power by standard industrial classification (SIC). The percentage of total sectoral outlays on electricity is shown for each of the 44 major sectors listed for 1990. While none of the sectors listed spends more than 5% of total outlays on electricity, there is some regional variation in the importance of electricity across the sectors. For the industrial sectors (sectors 10-39), the more electricity-intensive industries (paper [sector 26]; chemicals [sector 28]; rubber [sector 30]; stone, glass, and clay [sector 32]; and primary metals [sector 33]) show some variation in electricity usage per unit of output across the metropolitan subregions.

Despite differences in electricity intensity among the subregions, changes in electricity rates do not appear to have the potential to markedly increase the cost of doing business in any of these sectors. Table 6 shows the share of total employment in each of the three parts of the manufacturing sector in each subregion. Employment in mining (sectors 11-14) is highest in the Wyoming Metropolitan Subregion at almost 8%, while there are smaller percentages in the High Plains, Rocky Mountain, and Great Basin Subregions. Employment in nondurable manufacturing (sectors 20-29) is less than 4% of total employment in the area in which Western power is sold, with a high of 3.8% in the Utah Metropolitan Subregion. The share of total employment in durable manufacturing (sectors 30-39) is highest in the Arizona and Colorado Metropolitan Subregions, while there are smaller shares in the Utah Metropolitan and New Mexico Metropolitan Subregions. The industrial sectors do not constitute a significant proportion of total employment in any subregion; this is likely to be an important factor in small changes in overall regional economic activity resulting from changes in Western rates.

Differences in the magnitude of Western power sales and in the composition of sales to each of the three customer classes affect the subregions in which Western power is sold. As has been suggested, this situation may occur either because there are few Western

TABLE 5 Electricity Intensity by Industry and State: 1990

| SIC | Industry | Percent of Total Sector Outlays | | | | | |
		Arizona	Colorado	Nevada	New Mexico	Utah	Wyoming
1-9	Agriculture and forestry	0.56	0.56	0.56	0.56	0.56	0.56
10-14	Mining	0.97	0.66	0.66	0.73	0.76	0.47
15-17	Construction	0.18	0.18	0.18	0.18	0.18	0.18
20	Food and kindred products	0.76	0.53	0.76	0.76	0.82	0.23
21	Tobacco products	0.00	0.00	0.00	0.00	0.00	0.00
22	Textile mill products	0.00	0.00	0.00	1.80	0.00	0.00
23	Apparel and apparel products	0.00	0.49	0.00	0.60	0.41	0.00
24	Lumber and wood products	1.50	0.96	0.98	1.69	1.44	0.35
25	Furniture and fixtures	0.71	0.66	0.00	0.00	0.69	0.00
26	Paper and allied products	0.00	2.37	4.96	2.38	3.97	0.00
27	Printing and publishing	0.81	0.66	0.84	0.00	0.66	0.16
28	Chemicals and allied products	3.94	4.07	3.07	0.00	4.49	0.00
29	Petroleum refining	0.75	0.62	1.36	0.00	0.97	0.19
30	Rubber and miscellaneous plastics	2.12	1.59	0.00	2.06	1.91	0.00
31	Leather and leather products	0.00	0.00	0.00	0.00	0.00	0.00
32	Stone, clay, and glass products	2.37	2.11	1.71	0.00	1.20	0.00
33	Primary metals	2.40	0.00	0.00	1.00	2.49	0.00
34	Fabricated metals	1.22	1.10	0.00	1.09	0.94	0.00
35	Industrial machinery	1.00	0.96	0.91	0.77	0.87	0.18
36	Electronic and electrical equipment	1.06	0.98	0.00	1.01	0.98	0.00
37	Motor vehicles	0.54	0.48	0.79	0.00	0.33	0.00
37	Transportation equipment	0.72	0.65	1.06	0.00	0.45	0.00
38	Instruments	0.99	0.68	0.00	0.87	0.90	0.00
39	Miscellaneous manufacturing	0.00	0.80	0.00	1.00	0.00	0.00
45	Air transportation	0.01	0.01	0.01	0.01	0.01	0.01
41,42,47	All other transportation	0.00	0.00	0.00	0.00	0.00	0.00
48-49	Communications and public utilities	0.00	0.00	0.00	0.00	0.00	0.00
50-51	Wholesaling	1.01	1.01	1.01	1.01	1.01	1.01
58	Eating and drinking places	1.41	1.41	1.41	1.41	1.41	1.41
59	Miscellaneous retailing	2.03	2.03	2.03	2.03	2.03	2.03
60	Banking	0.92	0.92	0.92	0.92	0.92	0.92
61-62	Credit and finance	0.53	0.53	0.53	0.53	0.53	0.53
63-64	Insurance	0.20	0.20	0.20	0.20	0.20	0.20
65-67	Real estate	0.39	0.39	0.39	0.39	0.39	0.39
70	Hotels	2.97	2.97	2.97	2.97	2.97	2.97
72	Personal services and repairing	1.38	1.38	1.38	1.38	1.38	1.38

TABLE 5 (Cont.)

SIC	Industry	Percent of Total Sector Outlays					
		Arizona	Colorado	Nevada	New Mexico	Utah	Wyoming
73	Miscellaneous business services	0.68	0.68	0.68	0.68	0.68	0.68
75	Auto repair	1.31	1.31	1.31	1.31	1.31	1.31
78	Motion pictures	0.69	0.69	0.69	0.69	0.69	0.69
79	Amusement and recreation	1.44	1.44	1.44	1.44	1.44	1.44
80	Medical services	1.25	1.25	1.25	1.25	1.25	1.25
81,83,87,89	Miscellaneous professional services	0.44	0.44	0.44	0.44	0.44	0.44
82	Education services	1.36	1.36	1.36	1.36	1.36	1.36
84,86	Nonprofit organizations	1.22	1.22	1.22	1.22	1.22	1.22
	State average	1.14	1.05	1.18	1.06	1.14	0.82

Source: REMI.

TABLE 6 Manufacturing Industry Shares (%) of Total Employment by Subregion[a]: 1993

Subregion	Sectors[b]		
	11-14	20-29	30-39
Arizona Metropolitan	0.43	2.54	7.02
Colorado Metropolitan	0.76	3.29	7.63
Nevada Metropolitan	0.09	1.21	1.12
New Mexico Metropolitan	0.14	1.67	4.13
Utah Metropolitan	0.39	3.80	6.56
Wyoming Metropolitan	7.81	2.34	2.34
Great Plains	3.42	3.53	3.76
Rocky Mountain	4.41	2.70	1.74
Great Basin	3.23	1.91	1.98

[a] These data were estimated by using the REMI model.

[b] Sectors 11-14 = mining; sectors 20-29 = nondurable manufacturing; sectors 30-39 = durable manufacturing.

customer utilities serving the region or because Western customer utilities do not receive enough power from Western for changes in Western power rates to affect regional economic activity. However, the significance of either factor tends to vary across the subregions. Some regions have Western customer utilities, but each of those utilities may have a low level of reliance on Western for power; other areas may have few Western utilities but a high level of reliance on Western power. The importance of electricity inputs to subregional industries may also influence economic activity in subregions where changes in electricity rates and expenditures on electricity are larger.

2.3 REGIONAL ECONOMIC IMPACTS OF POWER MARKETING PROGRAMS — SUMMARY

The impacts of each commitment-level alternative and supply option were estimated for (1) population, GRP, disposable income, and employment in each of the nine subregions and (2) output, income, and employment in the two high-reliance counties. Additional analysis included the impacts on low-income and minority groups in the nine subregions.

2.3.1 Impacts on the Economies of Subregions

At the subregional level, rate increases at the utility level translate into impacts of less than 0.4% in the nine regions in which Western power is sold (see Tables 7 and 8).[1] The largest impacts generally occur toward the end of the power contract period in 2000 and 2008. The largest absolute impact is a decrease of 0.36% in disposable income under alternative 4C. Smaller decreases in each variable occur with the remaining alternatives, with positive impacts occurring under alternatives 1A, 1B, and 2A. Within each alternative, impacts are larger as one moves from the full flexibility supply option through low fluctuating flows to steady flows.

The absolute magnitudes of regional impacts under each alternative and supply option are small. There are, however, important differences in the relative impact of each alternative in each of the nine subregions. Three factors essentially determine the magnitude of the impact of each alternative. These are the (1) importance of Western power in each subregion (reliance of Western customers on Western power and the size of power sales by Western customer utilities), (2) composition of sales by Western customer utilities by customer class, and (3) importance of electricity as an industrial factor input to regional industries.

The significance of these factors on the relative magnitude of impacts can be seen through the impact of each alternative on GRP in the subregions where absolute impacts were largest. In the Colorado Metropolitan Subregion, economic impacts are related both to

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[1] Because impact estimates in the discussion and in the tables are rounded to two significant digits, many of the numbers appear as zeros.

TABLE 7 Maximum Estimated Impacts of Commitment-Level Alternatives and Supply Options on Population, GRP, Disposable Income, and Employment[a]: 2000

Alternative	Population		GRP		Disposable Income		Employment	
	Region[b]	Percent Change	Region[b]	Percent Change	Region[b]	Percent Change	Region[b]	Percent Change
NA-B	2	-0.01	2	-0.02	2	-0.02	2	-0.02
NA-C	2	-0.12	2	-0.19	2	-0.15	2	-0.14
1A	9	-0.04	9	+0.03	9	+0.04	2	+0.02
1B	5	-0.03	5	-0.03	5	-0.03	2	-0.03
1C	2	-0.12	2	-0.20	2	-0.15	2	-0.15
2A	2	+0.12	2	+0.19	2	+0.15	2	+0.14
2B	5	-0.09	5	-0.09	5	-0.13	5	-0.08
2C	5	-0.13	5	-0.13	5	-0.19	5	-0.11
3A	2	+0.06	2	+0.10	2	+0.08	2	+0.07
3B	5	-0.06	5	-0.06	5	-0.08	5	-0.05
3C	5	-0.11	5	-0.12	5	-0.16	5	-0.09
4A	9	-0.10	9	-0.09	9	-0.16	9	-0.08
4B	9	-0.11	9	-0.10	9	-0.18	9	-0.09
4C	9	-0.14	9	-0.13	9	-0.22	9	-0.11
5A	9	-0.09	9	-0.07	9	-0.10	9	-0.06
5B	9	-0.12	9	-0.09	9	-0.14	9	-0.07
5C	9	-0.15	2	-0.15	9	-0.18	2	-0.11
6A	5	-0.03	9	-0.04	9	-0.06	9	-0.03
6B	9	-0.06	9	-0.05	9	-0.09	9	-0.04
6C	9	-0.11	2	-0.14	9	-0.15	2	-0.11

[a] The data were estimated by using the REMI model.

[b] 1 = Arizona Metropolitan Subregion, 2 = Colorado Metropolitan Subregion, 3 = Nevada Metropolitan Subregion, 4 = New Mexico Subregion, 5 = Utah Metropolitan Subregion, 6 = Wyoming Metropolitan Subregion, 7 = High Plains Subregion, 8 = Rocky Mountains Subregion, and 9 = Great Basin Subregion.

TABLE 8 Maximum Estimated Impacts of Commitment-Level Alternatives and Supply Options on Population, GRP, Disposable Income, and Employment[a]: 2008

Alternative	Population Region[b]	Population Percent Change	GRP Region[b]	GRP Percent Change	Disposable Income Region[b]	Disposable Income Percent Change	Employment Region[b]	Employment Percent Change
NA-B	2	-0.02	2	-0.03	8	-0.05	2	-0.02
NA-C	2	-0.13	2	-0.20	2	-0.14	2	-0.13
1A	9	+0.05	5,9	+0.05	9	+0.09	9	+0.05
1B	9	-0.03	9	+0.04	9	+0.08	5	+0.04
1C	2	-0.13	2	-0.20	2	-0.14	2	-0.13
2A	2	+0.13	2	+0.20	2	+0.14	2	+0.13
2B	5	-0.10	5	-0.10	5	-0.14	5	-0.07
2C	5	-0.13	5	-0.12	5	-0.17	5	-0.08
3A	2	+0.07	2	+0.10	5	-0.10	2	+0.06
3B	5	-0.07	5	-0.08	5	-0.11	5	-0.06
3C	5	-0.12	2	-0.13	5	-0.18	5	-0.09
4A	9	-0.16	9	-0.16	9	-0.27	9	-0.14
4B	9	-0.17	9	-0.18	9	-0.29	9	-0.14
4C	5	-0.21	5	-0.23	5	-0.36	5	-0.19
5A	9	-0.05	9	-0.06	9	-0.07	9	-0.03
5B	9	-0.07	2	-0.09	9	-0.09	9	-0.05
5C	9	-0.10	2	-0.16	9	-0.12	2	-0.10
6A	2	+0.07	9	-0.05	9	-0.08	9	-0.04
6B	9	-0.06	9	-0.06	9	-0.09	9	-0.04
6C	2	-0.10	2	-0.15	9	-0.14	2	-0.10

[a] The data were estimated by using the REMI model.

[b] 1 = Arizona Metropolitan Subregion, 2 = Colorado Metropolitan Subregion, 3 = Nevada Metropolitan Subregion, 4 = New Mexico Subregion, 5 = Utah Metropolitan Subregion, 6 = Wyoming Metropolitan Subregion, 7 = High Plains Subregion, 8 = Rocky Mountains Subregion, and 9 = Great Basin Subregion.

the proportion of power sales made by Western and to the amount of power sold by Western customer utilities to industrial customers. In this subregion, the no-action alternative and alternative 5, which have the largest regional and average customer reliance on Western, result in the largest changes in GRP. This result contrasts with the situation in the Utah and Great Basin Subregions, where the largest impact on GRP occurs under alternatives 2, 4, and 5, in which the proportion of power coming from Western tends to be lower. Utilities in these two subregions sell primarily to municipals and cooperatives that resell to residential customers and agricultural customers that receive industrial rates for power. In the Arizona, Nevada, New Mexico, and Wyoming Metropolitan Subregions, the impacts of each alternative are smaller because there is low regional reliance on Western power.

2.3.2 Impacts on the Economies of High-Reliance Counties

For the two high-reliance counties, deviations in output, personal income, and employment from the baseline in the three years examined would be less than 2% for each of the alternatives and supply options and would be less than 1% in most cases (see Table 9 in Section 3.4).

The analysis that uses IMPLAN for the two high-reliance counties uses changes in electricity expenditures resulting from each commitment-level alternative and supply option as input data. The analysis for the subregions that uses REMI uses changes in commercial and industrial electricity prices and changes in residential expenditures on electricity as input data. The results of the analyses, which are at two geographic scales and use the two modeling frameworks, are therefore not directly comparable. However, the relative importance of impacts of each commitment-level alternative and supply option for the two counties and for each subregion can still be compared by examining the percentage change in each variable from the baseline for each of the scenarios at each geographic scale.

2.3.3 Impacts on Low-Income Households and Minority Populations in the Nine Subregions

Changes in annual incomes resulting from each alternative and supply option were estimated for 11 household income groups in each of the nine subregions. The analysis was undertaken for three representative years: 1993, 2000, and 2008. The results of the analysis indicated that the income of low-income households would decrease slightly for most alternative/supply option combinations. Estimates of the impact of each commitment-level alternative and supply option on households with annual incomes of less than $30,000 show that less than 1% of households would experience a decrease in annual income of more than $500 (Table 10). In most cases, fewer than 0.01% of households would receive a decrease in annual income under each commitment-level alternative and supply option. The largest impact on low-income households would occur in the Great Basin Subregion in 1993 under alternative/supply option combinations 4C and 5C, where 0.7% of households would receive a decrease in annual income of more than $500. Smaller impacts would occur in the same subregion in 2000 and 2008 under these alternatives and supply options, and under

alternative/supply option combinations 1C, 2C, 3C, and 6C in the Great Basin and High Plains Subregions in each of the three years.

The regional impacts of the alternatives were most significant in the Great Basin and Utah Metropolitan Subregions, with smaller impacts in the Colorado Metropolitan Subregion. In these subregions, Alternative 4C had the largest impact on population, GRP, disposable income and employment; smaller impacts resulted from Alternatives 4A, 4B, and 5C. Because there is a higher concentration of American Indians in the Great Basin Subregion than in other parts of the area in which Western power is sold, the alternatives are likely to have a more disproportionate effect on this group than on other population groups in this subregion. Other concentrations of minority groups, such as Hispanics, are found in the other areas in which Western power is sold, particularly in the New Mexico Metropolitan, High Plains, and Rocky Mountain Subregions. However, because the impacts of each of the alternatives and supply options in each of the subregions would be small, the impact on minority groups is also expected to be small.

3 DESCRIPTION OF THE ECONOMY OF THE REGION IN WHICH WESTERN POWER IS SOLD

3.1 DEFINITION OF THE STUDY REGION

The region in which Western sells electricity includes most counties in four states (Arizona, Colorado, New Mexico, and Utah) and parts of eight states (California, Oklahoma, Montana, Nebraska, Nevada, South Dakota, Texas, and Wyoming). The counties that make up this area were defined on the basis of a calculation of the proportion of locally consumed power coming from Western in 195 counties in those 12 states. Appendix A lists the individual counties, and Figures 1 and 2 show their locations. Analysis of electricity sales to utilities in each of these counties included sales to the various generation and transmission
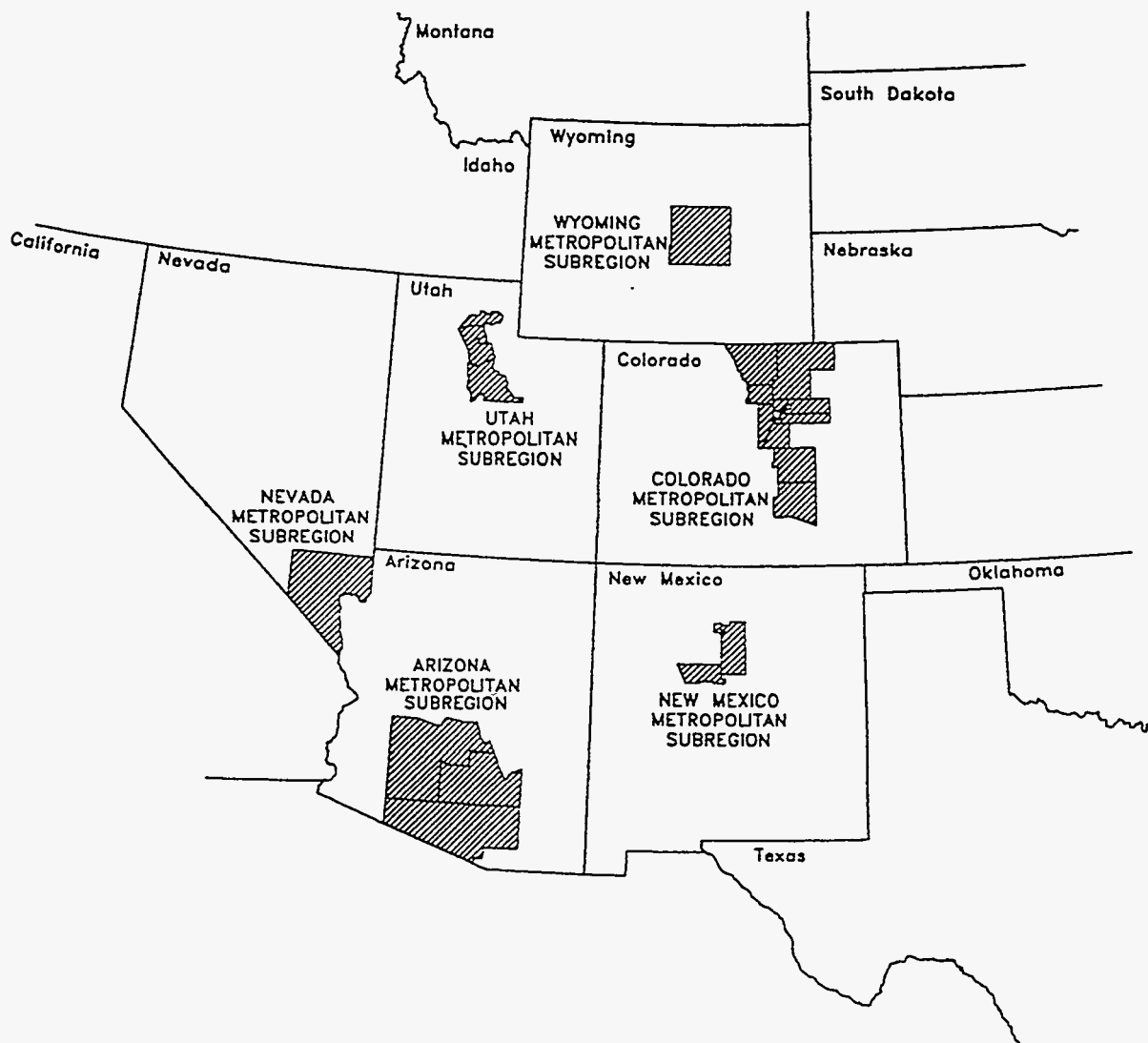
FIGURE 1 Counties in the Metropolitan Subregions
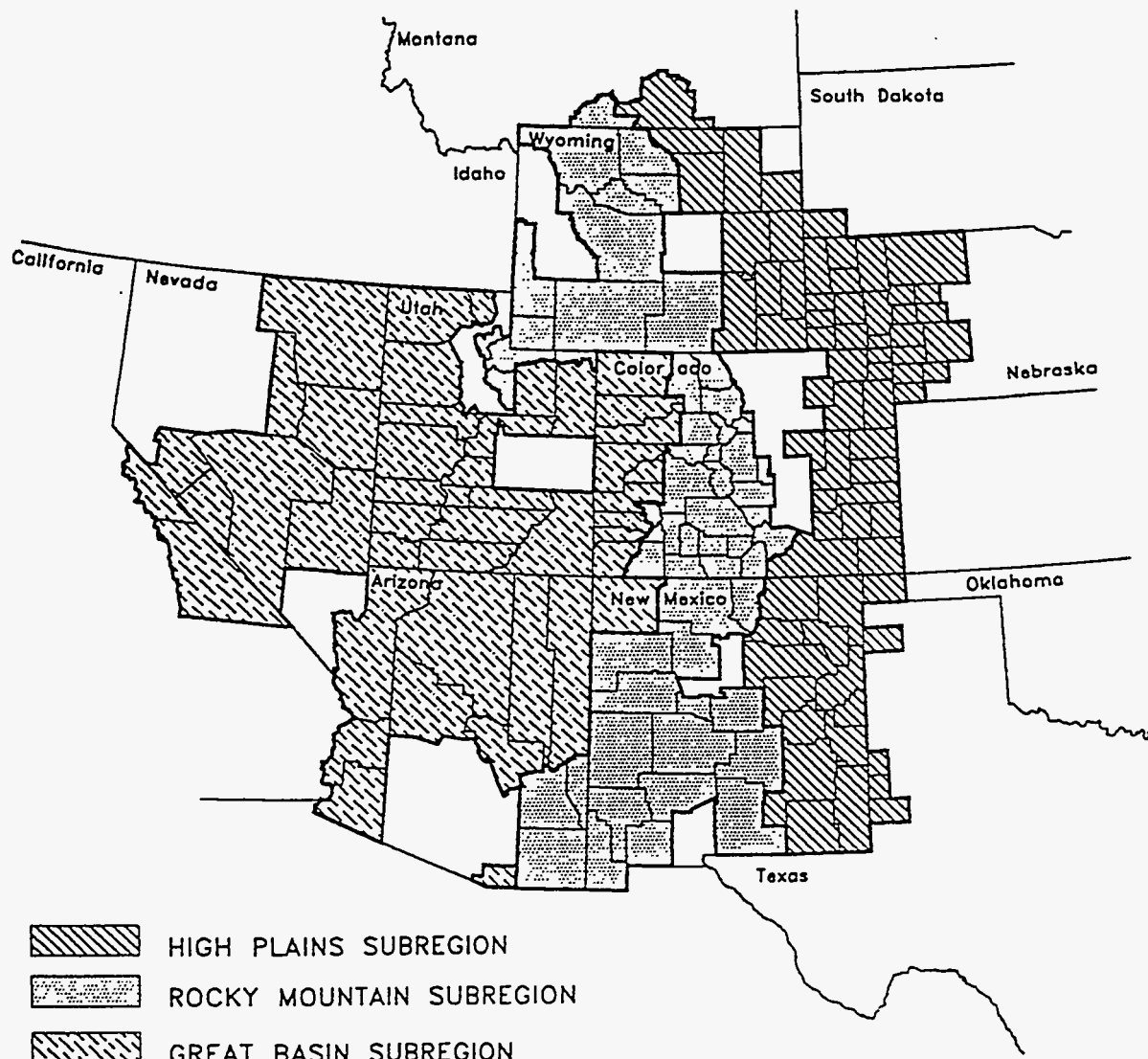
FIGURE 2 Counties in the Rural Subregions

cooperatives, rural electrification authorities, and other joint action agencies for most cases and to end-users in a small number of cases. Information on customers came from the post-1989 customer list provided by Western. The *Electrical World Directory of Electric Utilities* (1989, 1992) provided data on the counties served by each of these utilities receiving Western power.

At least one Western distribution utility operates primarily in each of Utah, Arizona, Colorado, New Mexico, Wyoming, Nevada, and Nebraska. In addition, at least one Western distribution utility sells power in each of Texas, California, South Dakota, Oklahoma, and Montana. For these additional states, information from Energy Information Administration (EIA) Form 861 for 1987 for each distribution utility was examined to determine whether significant quantities of power were sold in these states by those utilities. The percentage

of retail sales for each distribution utility in counties in these states was calculated and was deemed insignificant if it was less than 5% of the total quantity of electricity sold on the retail market in each county by the distribution utility.

3.2 CHOICE OF GEOGRAPHIC SCALE FOR THE ESTIMATION OF IMPACTS

Analysis of the regional economic impacts of changes in electricity prices could be conducted at different geographic scales, including individual county, power pool,[2] or all 195 counties in the area served by Western power as a group. Analysis at the county level is the standard approach to modeling the regional impacts of given changes in economic activity. However, the absence of numerous industries in many of the county economies, the importance of the electricity sector compared with other industries in these counties, and problems with the measurement of cross-boundary flows of electricity would make analysis at the county level problematical. Analysis at the power pool level would be complicated by data limitations and an incomplete match between power pools and individual counties or groups of counties. Analysis of the entire affected area as a whole would also be inappropriate, since the region in which Western sells power contains a variety of economic activities located in rural, semirural, and urban areas. Changes in electricity rates can affect different economic activities. Because of the heterogeneity of the economy of the affected area, analysis of the impacts of electricity rate changes on various economic activities over the entire area would not provide a detailed account of the magnitude of impacts for the specific areas in which those economic activities are located.

Consequently, to more accurately assess the potential impacts a change in Western's power marketing program might have, the 195 counties were divided into a series of subregions designed to capture impacts across a range of economic activities. Counties receiving Western power were grouped into metropolitan and nonmetropolitan counties. Most of the metropolitan subregions served by Western power have relatively diversified economies, while each of the rural subregions is organized around a relatively undiversified economic base. The metropolitan counties were then divided into six separate subregions corresponding to the six consolidated metropolitan statistical areas served by Western power; the nonmetropolitan counties were grouped into three subregions corresponding to three broad rural regions with similar topographical and economic features.

A larger number of subregions might have been chosen to provide a more detailed analysis of the impacts of changes in power marketing programs on individual sectors at a more specific geographical level. However, the level of diversification within most of the counties in each metropolitan subregion makes it unlikely that any single industry suffering significant adverse effects from changes in rates would have any effect on the overall regional economic well-being. Similarities in economic base across counties within each of the three nonmetropolitan subregions mean that the impacts of changes in electricity rates are not

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[2] A power pool is an organization of interconnected electric utilities that plan and coordinate the production, transmission, and distribution of electricity.

obscured by the overall size of the subregions. Any significant impacts on specific industries (such as agriculture) due to changes in electricity rates are measurable, despite the size of the subregions, because of the importance of employment and output from these activities in each of the three subregions.

The analysis of regional economic impacts that uses the REMI modeling framework assessed impacts that would occur in nine separate subregions, each consisting of counties receiving Western power. The analysis essentially averages the impact of each commitment level alternative and supply option across all utilities in these subregions. The three rural subregions are geographically large and contain a number of Western customer utility service territories. To provide an indication of the magnitude of impacts of each commitment level alternative within an individual utility service territory, additional analysis was also performed at the county level for an extreme case in which both reliance on Western and customer utility rate increases were the highest among all the counties in the affected area.

On this basis, two separate counties in New Mexico were chosen, one from the Great Basin Subregion and one from the Rocky Mountain Subregion. Both counties contained more than one Western customer utility, with utility reliance on Western power ranging from approximately 20% to more than 75%. These statistics translate into an overall county reliance on Western power ranging from 20% in one county to 59% in the other. Neither county contains a non-Western customer selling to end-use customers. Changes in retail electricity rates in these counties under each alternative and supply option would be relatively large, with a maximum change from the baseline of more than 22% in both counties. The identity of these counties is not disclosed in accordance with the terms of a confidentiality agreement to protect individual utility data from being revealed.

Analysis of the impacts of changes in retail electricity rates on specific agricultural activities was included in the analysis of impacts undertaken for the Western EIS. In this analysis, the impacts on irrigated agriculture were assessed at the state level for the six states of Arizona, Colorado, Nevada, New Mexico, Utah, and Wyoming and for five groups of counties in Colorado and Utah chosen on the basis of the share of county income coming from agricultural sources and the share of power sold by utilities serving these counties coming from Western. Crops analyzed were barley, hay, corn grain, corn silage, wheat, and sorghum. A full description of data, methods, and findings can be found in Edwards et al. (1995).

3.3 DESCRIPTION OF ECONOMIC BASE REGIONS

The six metropolitan subregions and three rural subregions were defined according to similarities in economic base. The boundaries of each subregion were determined by identifying groups of counties with similar economic structure, defined in terms of employment levels in each of the major SIC groups in each county reported in *County Business Patterns* data (U.S. Bureau of the Census 1990). The nine subregions are illustrated in Figures 1 and 2. The nine subregions are the Arizona Metropolitan Subregion, Colorado Metropolitan Subregion, Nevada Metropolitan Subregion, New Mexico Metropolitan

Subregion, Utah Metropolitan Subregion, Wyoming Metropolitan Subregion, High Plains Subregion, Rocky Mountains Subregion, and Great Basin Subregion. The individual counties included in each of the nine subregions are listed in Appendix A.

3.3.1 Metropolitan Counties

Each of the six states in the affected area (Arizona, Colorado, Nevada, New Mexico, Utah, and Wyoming) has at least one metropolitan county. Within these counties, the larger metropolitan centers of Phoenix (Maricopa County; 1988 employment 975,200), Denver/Boulder (Adams, Arapahoe, Boulder, Denver, and Jefferson counties; 952,200), and Salt Lake City (Davis, Salt Lake, and Webber counties; 473,500) have highly diversified economies, with a range of manufacturing, consumer, and producer service activities. Las Vegas (Clark County; 270,247) is a growing regional center based on gaming and hospitality, and it is attempting to diversify its economy. In all but two of these counties, at least 80% of the population is located in urban areas. Additionally, for most of these counties, agriculture and resource extraction constitutes less than 2% of the total county employment.

A number of smaller metropolitan centers (Albuquerque/Santa Fe [Bernalillo and Santa Fe Counties; 210,152] Colorado Springs [El Paso County; 122,359], Fort Collins [Larimer County; 50,613], Greeley [Weld County; 34,501], Pueblo [Pueblo County; 30,159], Casper [Natrona County], and Tucson [Pinal County; 14,632]) specialize in fewer economic activities, with an emphasis on service employment. Each of these counties has an essentially urbanized population and less than 5% of county employment in agriculture and resource extraction. Figure 1 is a map of the metropolitan subregions in the affected area.

3.3.2 Nonmetropolitan Counties

The remainder of the counties in each state are rural and, in many cases, remote, with few large centers of population. The economies in these counties are based primarily on agriculture, resource extraction, recreation, and tourism. These counties are grouped into three separate regions (the High Plains Subregion, the Rocky Mountain Subregion, and the Great Basin Subregion), and they are used as the basis for the remainder of the regional impact analysis. Figure 2 maps the counties included in the three rural subregions.

3.3.2.1 High Plains

A group of High Plains counties to the east of the Rocky Mountains in western Colorado, western New Mexico, and central Wyoming is considered as a separate region in the regional impact analysis. With the exception of the area to the north and south of the Platte River irrigation project, the regional economy is based primarily on ranching. Wyoming and New Mexico have substantial interests in the energy economy; oil, gas, and coal are recovered in Wyoming, oil and gas in New Mexico.

3.3.2.2 Rocky Mountains

The Rocky Mountain Subregion consists of the central section of the affected area. The region varies in width and covers north central Wyoming, western Colorado, and New Mexico. This area is sparsely populated, and the economy is based primarily on recreation and tourism, although its earlier development was based on the timber and minerals (hard metals) industries. Topographic features and poor proximity to urban markets have limited further development. A significant proportion of the land surface in the region is owned or administered by U.S. government agencies.

3.3.2.3 Great Basin

Between the Rocky Mountains and the Sierra Nevada range in eastern California is a region of high desert, including western Wyoming and all of Utah, Arizona, and Nevada. The geographic distribution of water resources has determined the location and level of economic activity throughout this area, and the main centers of population have grown largely in response to man-made changes in regional hydrological systems, particularly in southwestern Nevada and in central and southwestern Arizona. Most of the agricultural activity is located near the urban centers in Maricopa and Pinal Counties in Arizona, and there is a smaller concentration in Clark County, Nevada. The agricultural sector is highly capital intensive and accounts for less than 1% of total employment in most of the counties. Tourism and recreation have become a significant part of the region's economy, with both mountain-based and water-based activities. As occurs in the Rocky Mountain Subregion, a significant proportion of the land surface in the Great Basin Subregion is owned or administered by U.S. government agencies in the form of national parks and Indian reservations.

3.4 DEMOGRAPHIC AND ECONOMIC INDICATORS

The baseline is defined as the conditions predicted to prevail under the post-1989 marketing criteria for the years 1993-2008. To adequately assess the possible effects of a change in Western's power marketing programs, four key variables were selected to describe the baseline socioeconomic conditions in the study region and subregions. These variables were population, including minority groups, and three economic indicators: employment, real disposable income (i.e., total real income adjusted for taxes and transfer payments), and real GRP. Table 9 presents estimates of the baseline values of these variables. Section 3.4.2.4 describes the distribution of annual household incomes in each subregion.

TABLE 9 Population, Employment, Disposable Income, and GRP by Subregion[a]

Sub-region[b]	Population (10³)		Average Annual Change (%)	Employment (10³)		Average Annual Change (%)
	1993	2008		1993	2008	
1	3,264.3	4,597.1	+2.3	1,737.0	2,366.8	+2.1
2	2,398.7	2,890.4	+1.3	1,265.6	1,566.9	+1.4
3	778.2	1,072.8	+2.2	431.2	590.0	+2.1
4	683.7	936.1	+2.1	410.9	546.5	+1.9
5	1,440.6	1,698.2	+1.1	743.2	915.6	+1.4
6	58.5	64.6	+0.7	37.6	43.7	+1.0
7	1,325.3	1,380.0	+0.3	610.3	684.9	+0.8
8	835.1	817.5	-0.1	435.5	459.1	+0.4
9	1,026.2	1,114.6	+0.6	456.6	521.9	+0.9
Total	11,810.8	14,571.3	+1.4	6,127.8	7,695.5	+1.5

Sub-region[b]	Disposable Income (10⁹ 1994 $)		Average Annual Change (%)	GRP (10⁹ 1994 $)		Annual Annual Change (%)
	1993	2008		1993	2008	
1	36.7	59.5	+3.3	47.9	73.5	+2.9
2	30.2	44.7	+2.6	35.0	50.2	+2.4
3	8.6	14.2	+3.4	11.6	16.8	+2.5
4	7.9	12.7	+3.2	11.7	17.1	+2.6
5	14.0	20.2	+2.4	21.2	30.2	+2.4
6	0.8	1.1	+2.2	1.9	2.4	+1.6
7	10.4	12.9	+1.5	14.4	17.4	+1.2
8	10.2	13.8	+2.1	14.0	17.8	+1.6
9	12.2	16.1	+1.8	18.3	22.6	+1.4
Total	131.0	195.2	+2.7	175.9	248.0	+2.3

[a] The data were estimated by using the REMI model.

[b] 1 = Arizona Metropolitan Subregion, 2 = Colorado Metropolitan Subregion,
3 = Nevada Metropolitan Subregion, 4 = New Mexico Metropolitan Subregion,
5 = Utah Metropolitan Subregion, 6 = Wyoming Metropolitan Subregion,
7 = High Plains Subregion, 8 = Rocky Mountains Subregion, and 9 = Great
Basin Subregion.

3.4.1 Population

3.4.1.1 Distribution

According to Table 9, 11.8 million individuals were estimated to live in the study region in 1993. The Arizona and Colorado Metropolitan Subregions account for approximately half of this total. This relationship is predicted to remain relatively stable over the forecast period. Total population in the region is predicted to grow at an annual rate of approximately 1.4% — from 11.8 million to 14.6 million — between 1993 and 2008. Population growth is expected to be most rapid in the Arizona Metropolitan Subregion, with an average annual growth rate of approximately 2.3%. In contrast, the population in the Wyoming Metropolitan Subregion is predicted to decline in both relative and absolute terms, falling from 835,000 to 817,000 over the forecast period.

3.4.1.2 Minority Groups

Within the affected area, minorities made up 14.6% of the total population in 1990 (see Table 10). The minority population is concentrated primarily in the New Mexico Metropolitan Subregion (with 22% of the total population), Great Basin Subregion (19.7%), Nevada Metropolitan Subregion (18.7%), and Rocky Mountain Subregion (18.2%). Within the minority population group, Hispanic (15.6%), American Indian (3.7%), and black (2.7%) populations were present in significant numbers. These three minority groups are distributed somewhat unevenly across the affected area, with Hispanics making up 38.4% of the population in the New Mexico Metropolitan Subregion, 24% in the Rocky Mountain Subregion, and 20% in the High Plains Subregion. Smaller concentrations of Hispanics occur in the Arizona Metropolitan (18.7%), Great Basin (11.6%), and Nevada Metropolitan (11.2.%) Subregions. The American Indian population is concentrated primarily in the Great Basin (13.6%) and Rocky Mountain (9.5%) Subregions, with smaller concentrations elsewhere in the affected area. The black population is more concentrated in the Nevada Metropolitan Subregion (9.5%), with smaller populations in the Arizona (3.4%) and Colorado Metropolitan (3.2%) Subregions.

3.4.2 Economic Indicators

Table 9 provides estimates of GRP, disposable income, and employment. Together, these three variables provide an overview of the aggregate level of economic activity in the study region and in each of the nine subregions. According to the data, economic activity is predicted to grow at a moderate pace over the forecast period.

TABLE 10 Distribution of Minorities by Subregion: 1990[a]

Sub-region[b]	Hispanic	Black	American Indian	Asian & Pacific Islander	Other	Total Minority Population	Total Population
1	542,822	98,700	69,132	48,760	277,153	493,745	2,905,360
	18.68%	3.40%	2.38%	1.68%	9.54%	16.99%	
2	237,110	70,236	14,584	46,117	86,336	217,273	2,218,731
	10.69%	3.17%	0.66%	2.08%	3.89%	9.79%	
3	82,904	70,738	6,416	26,043	35,604	138,801	741,459
	11.18%	9.54%	0.87%	3.51%	4.80%	18.72%	
4	229,257	13,910	19,244	8,327	90,240	131,721	597,620
	38.36%	2.33%	3.22%	1.39%	15.10%	22.04%	
5	70,452	10,838	10,250	29,556	31,495	82,139	1,335,817
	5.27%	0.81%	0.77%	2.21%	2.36%	6.15%	
6	2,252	458	404	280	761	1,903	61,226
	3.68%	0.75%	0.66%	0.46%	1.24%	3.11%	
7	168,247	12,401	13,759	4,775	75,817	106,752	839,708
	20.04%	1.48%	1.64%	0.57%	9.03%	12.71%	
8	238,407	13,294	94,232	6,997	66,188	180,711	995,372
	23.95%	1.34%	9.47%	0.7%	6.65%	18.16%	
9	158,588	9,252	186,250	9,806	64,534	269,842	1,367,451
	11.60%	0.68%	13.62%	0.72%	4.72%	19.73%	
Total	1,730,039	299,827	414,271	180,661	728,128	1,622,887	11,062,744
	15.64%	2.71%	3.75%	1.63%	6.58%	14.67%	

[a] Persons of Hispanic origin may also be included in the totals for any population group.

[b] 1 = Arizona Metropolitan Subregion, 2 = Colorado Metropolitan Subregion, 3 = Nevada Metropolitan Subregion, 4 = New Mexico Metropolitan Subregion, 5 = Utah Metropolitan Subregion, 6 = Wyoming Metropolitan Subregion, 7 = High Plains Metropolitan Subregion, 8 = Rocky Mountain Subregion, 9 = Great Basin Subregion.

Source: 1990 Census of Population.

3.4.2.1 Gross Regional Product

For 1993, real GRP (measured in 1994 dollars) is estimated to be approximately $176 billion (Table 9). This figure is expected to rise to $248 billion by 2008, which translates to an average annual growth rate of 2.3%. As occurred with regard to population, employment, and income, the Arizona and Colorado Metropolitan Subregions dominate, with approximately 47% of total real GRP. This share is predicted to rise to approximately 50% by 2008. All nine subregions are expected to experience an increase in GRP over the forecast period. The Arizona and New Mexico Metropolitan Subregions are predicted to experience the highest growth rates, while real GRP in the High Plains Subregion is predicted to grow at the slowest rate.

3.4.2.2 Employment

The number of individuals employed in the study region is predicted to increase by an average of 1.5% per year, from 6.1 million workers in 1993 to just less than 7.7 million in 2008 (Table 9). The Arizona and Colorado Subregions combined account for approximately 49% of the total in 1993 and slightly more than 51% of the total in 2008. The Nevada Metropolitan Subregion is predicted to experience the highest average annual growth rate, 2.1%. In contrast, employment in the Great Basin Subregion is predicted to grow at an annual rate of 0.4% over the same period. Overall, relative growth rates across subregions are consistent with the relative growth rates in population reported in Section 3.4.1.

Employment is most heavily concentrated in the wholesale and retail sector and in the business and public services sector in each of the metropolitan subregions. These two sectors account for approximately 51-68% of total employment in these six subregions. In contrast, employment is more evenly distributed across sectors in the rural subregions; no sector accounts for more than 25% of total employment. By 2008, the share of total employment in the retail and wholesale sector and in the business and public services sector in the six metropolitan subregions will range from 52% to 70%; no sector in the three rural subregions will account for more than 23% of total employment (Table 11).

3.4.2.3 Real Disposable Income

Real disposable income in the study region is predicted to increase by an average of 2.7% per year, rising from $131 billion in 1993 to just more than $195 billion in 2008 (Table 9). The Arizona and Colorado Subregions combined account for approximately 51% of the total in 1993 and slightly more than 53% of the total in 2008. The Nevada Metropolitan Subregion is predicted to experience the highest average annual growth rate, 3.4%. In contrast, real disposable income in the High Plains Subregion is predicted to grow at an annual rate of 1.5% over the same period. Once again, relative growth rates across subregions are consistent with the relative growth rates in population reported in Section 3.4.1.

TABLE 11 Employment (10^3) by Industrial Sector and Subregion: 1993 and 2008[a]

Sector[c]	Year	Subregion[b]									Total
		1	2	3	4	5	6	7	8	9	
01-02	1993	10.2	14.2	0.4	0.9	5.3	0.4	42.2	21.6	25.6	120.8
	2008	8.3	11.7	0.3	0.7	4.3	0.3	34.6	17.7	21.0	98.9
07-09	1993	20.4	12.4	3.2	2.2	4.4	0.3	13.2	6.9	5.6	68.6
	2008	30.1	16.9	4.3	3.3	6.7	0.4	17.2	7.9	7.2	94.0
11-14	1993	7.9	10.0	0.4	0.6	3.0	3.0	21.2	19.5	15.7	81.3
	2008	8.4	11.1	0.4	0.6	3.2	3.0	19.5	18.5	15.3	80.0
15-17	1993	103.4	64.6	32.0	22.6	34.1	2.2	36.3	20.5	27.4	343.1
	2008	151.6	88.7	39.5	31.2	46.2	2.8	45.4	25.5	35.2	466.1
20-29	1993	45.8	43.1	5.3	7.0	29.5	0.9	21.9	11.9	9.3	174.7
	2008	55.0	44.9	6.1	7.7	32.3	0.8	22.3	12.1	9.8	191.0
30-39	1993	126.5	100.1	4.9	17.3	50.9	0.9	23.3	7.7	9.6	341.1
	2008	120.5	88.5	5.1	16.4	49.5	0.8	21.6	7.2	9.4	319.0
40-49	1993	70.7	45.2	19.7	16.4	37.8	2.0	27.4	27.1	18.8	265.1
	2008	84.9	50.5	22.7	18.7	42.4	2.0	28.4	26.4	19.3	295.3
50-59	1993	383.5	268.5	80.4	87.5	163.9	9.4	123.7	89.6	93.4	1299.9
	2008	525.1	343.6	109.8	115.5	203.6	10.7	140.5	97.1	109.5	1655.4
60-69	1993	189.1	121.8	29.6	33.1	57.9	2.7	34.3	23.3	29.1	529.9
	2008	243.4	145.8	35.7	41.2	68.4	3.1	34.5	24.2	30.8	627.1
70-79	1993	288.7	202.6	160.8	75.4	112.2	6.1	88.3	47.8	76.1	1058.0
	2008	442.1	286.3	237.8	113.6	161.9	8.2	117.7	58.8	99.2	1525.6

TABLE 11 (Cont.)

Sector[c]	Year	Subregion[b]									Total
		1	2	3	4	5	6	7	8	9	
80-83	1993	241.5	163.8	40.3	57.9	108.4	4.7	74.8	48.7	45.3	785.4
	2008	378.3	238.3	62.8	87.0	150.3	6.3	96.9	60.7	61.0	1441.6
Government	1993	249.2	219.4	54.4	89.9	135.8	5.0	90.2	104.5	120.1	1068.5
	2008	319.2	240.6	65.8	110.6	146.8	5.2	86.3	107.3	119.9	1201.7
Total	1993	1800.9	1310.6	437.5	418.5	775.5	38.4	619.1	441.2	485.8	
	2008	2493.4	1667.0	595.2	563.8	966.5	44.5	688.2	471.1	547.2	

[a] The data were estimated by using the REMI model.

[b] 1 = Arizona Metropolitan Subregion, 2 = Colorado Metropolitan Subregion, 3 = Nevada Metropolitan Subregion, 4 = New Mexico Metropolitan Subregion, 5 = Utah Metropolitan Subregion, 6 = Wyoming Metropolitan Subregion, 7 = High Plains Subregion, 8 = Rocky Mountains Subregion, and 9 = Great Basin Subregion.

[c] 01-02 = Agricultural Production, 07-09 = Agricultural Services, Forestry and Fisheries, 11-14 = Mining, 15-17 = Contract Construction, 20-29 = Non-Durable Manufacturing, 30-39 = Durable Manufacturing, 40-49 = Transportation and Other Public Utilities, 50-59 = Wholesale and Retail Trade, 60-69 = Finance, Insurance and Real Estate, 70-79 = Private Services, 80-89 = Public Services.

3.4.2.4 Low-Income Groups

Each of the subregions in the affected area contains households in a range of annual income groups. The number and percentage of households with annual household incomes of less than $30,000 in each of the nine subregions for the three years 1993, 2000, and 2008 is shown in Table 12. In 1993, the High Plains and Great Basin Subregions both had more than 70% of households in this group. The remaining subregions had between 50% and 63% of households in this income group. More information on the distribution of annual household income in each of the subregions can be found in Rose and Frias (1993).

TABLE 12 Households with Annual Incomes of $30,000 or Less, by Subregion and Year

Subregion[a]	1993			2000			2008		
	<$30,000	Total	%	<$30,000	Total	%	<$30,000	Total	%
1	919,989	1,640,343	56.09	930,890	1,987,446	46.84	909,716	2,239,376	40.62
2	674,619	1,242,514	54.29	654,354	1,416,690	46.19	617,579	1,537,493	40.17
3	281,586	570,647	49.35	275,732	594,174	46.41	273,655	685,893	39.90
4	239,418	393,790	60.80	240,601	467,437	51.47	229,707	524,606	43.79
5	375,445	704,362	53.30	363,497	800,687	45.40	345,896	867,411	39.88
6	25,251	40,013	63.11	25,820	44,088	58.56	24,025	46,682	51.47
7	221,403	302,195	73.30	174,830	296,754	58.90	131,005	295,826	44.30
8	266,398	462,877	57.55	258,079	502,118	51.40	242,764	527,435	46.22
9	423,973	597,816	70.90	344,019	605,092	56.90	258,597	626,891	41.30
Total	3,428,082	5,954,557	57.57	3,267,822	6,714,486	48.67	2,774,347	7,351,613	37.74

[a] 1 = Arizona Metropolitan Subregion, 2 = Colorado Metropolitan Subregion, 3 = Nevada Metropolitan Subregion, 4 = New Mexico Metropolitan Subregion, 5 = Utah Metropolitan Subregion, 6 = Wyoming Metropolitan Subregion, 7 = High Plains Subregion, 8 = Rocky Mountains Subregion, and 9 = Great Basin Subregion.

Source: Rose and Frias (1993).

4 DESCRIPTION OF METHODS USED TO MEASURE REGIONAL ECONOMIC IMPACTS

This section begins with a brief outline of the scope of the analysis of regional economic impacts of changes in retail rates. The variables used in the analysis are described. These are changes in the cost of doing business, changes in household spending, and impacts on household income groups. A comparison of impact estimation methods that can be used to measure regional impacts by using these variables is then presented. This is followed by a comparison of available regional economic impact models, a description of the REMI and IMPLAN models chosen for the EIS, and a description of the input data estimation procedures used for each modeling framework.

4.1 SCOPE OF THE ANALYSIS OF REGIONAL ECONOMIC IMPACTS

To fully capture the regional impacts of existing and planned power marketing alternatives on the economy of each subregion in which Western power is sold, the regional impacts of changes in retail rates are measured in three areas: the cost of doing business for industries in each subregion, household expenditures, and expenditures on electricity by lower household income groups. The impacts of changes in rates on each of these areas have both direct and secondary impacts on the economy of the region in which Western power is sold. Direct impacts occur as industries and households cut back production and change spending behavior, respectively. Secondary impacts occur as industries and households adjust their spending patterns in response to changes in the level of spending by industries and households directly affected in each subregion. This section briefly describes the way changes in power rates affect the cost of doing business, household spending patterns, and lower income households in each subregion. A brief description of the importance of the direct and secondary impacts of changes in electricity rates is then presented.

4.1.1 Changes in the Cost of Doing Business

The first area in which there will be impacts from changes in Western rates is the cost of doing business for industrial and commercial customers. Changes in rates and the consequent changes in the cost of doing business will have impacts in both the short term and the long term. In the short term, increased electricity costs will likely result in output reductions in most of the industries in each subregion as local industries begin to purchase output from areas outside the Western service territory where electricity prices have not increased. In the longer term, industries in each subregion will change their production technologies in favor of less electricity intensive capital equipment or technologies that substitute labor for capital equipment. Changes in regional product mix will also occur, together with changes in consumption patterns, as each of the subregional economies adjusts to new levels of local economic activity.

4.1.2 Impacts of Changes in Household Spending

Another area that will be affected by changes in Western electricity rates is individual household expenditure patterns. Electricity forms a part of domestic budgets, and changes in rates will reduce the proportion of total expenditures by households for the purchase of other goods and services. Changes in household expenditures on electricity will, in the short term, result in reduced demand for locally produced goods and services and the substitution toward goods and services produced outside the area in which Western power is sold. In the longer term, higher electricity rates may lead to lower population growth rates and lower levels of net inward migration because of relative increases in the cost of living.

4.1.3 Impacts on Lower Income Households

Changes in electricity prices are also likely to affect the distribution of income among households in the various income groups. Because lower income households spend a higher proportion of their incomes on electricity, the impact of rate changes will be relatively higher for lower income groups than for upper income groups. The analysis of the impacts of changes in power marketing programs on household income provides information on which income groups are shouldering the burden of changes in retail electricity rates, compared with all groups as a whole. Analysis of household income impacts also allows identification of the amount of potential public support for changes in power marketing programs by gauging how each marketing alternative affects specific income groups.

4.1.4 Changes in Output, Income, and Employment in High-Reliance Counties

Because the analysis of the regional impacts of each commitment-level alternative and supply option considers impacts at the subregional level, the analysis essentially averages the impacts across all utilities in these subregions. The three rural subregions are geographically large and contain a number of Western customer utility service territories. To provide an indication of the magnitude of impacts of each commitment-level alternative within an individual utility service territory, additional analysis was also performed at the county level for an extreme case, in which both reliance on Western and customer utility rate increases were the highest among all the counties in the affected area. The impact of changes in electricity rates in the two counties were estimated by using the IMPLAN modeling system and were measured in terms of changes in output, employment, and income.

4.1.5 Direct and Secondary Impacts

Direct impacts occur as industries in those sectors of the economy that sell inputs directly to the electricity sector change production levels and expenditures for inputs to their production processes. The direct impact of changes in electricity output resulting from changes in rates charged by a utility generating electricity by using fossil fuel, for example,

would be a reduction in output from sectors that supply fuel and transportation services or, in the long term, from sectors that supply capital equipment. Households associated with industries in each of these sectors would also reduce expenditures as changes in earnings and employment levels occur.

Secondary impacts occur as industries and households not directly affected by these changes adjust their spending patterns in response to changes in expenditures by the industries that are directly affected. These secondary impacts arise from a reduction in demand for the various inputs needed for the production of output from the industries or households that are initially affected. Secondary impacts on industries occur as industries that sell materials and services to a particular sector reduce both their output and their demand for inputs from other industries. A change in the level of activity in the electricity sector, for example, will lead to changes in the level of activity in each of the sectors that provide materials and services to electric utilities.

The size of the overall impact depends to a large extent on the relative importance of the direct and secondary impacts resulting from changes in the level of activity in any sector, which in turn are related to the level of diversification and the reliance on trade in each region. In general terms, smaller, relatively undiversified economies are likely to experience larger direct impacts and smaller secondary ones. This result occurs because many of the sectors in such an economy are more likely to import the necessary materials and services from outside the region. Some utilities, for example, may import a large proportion of their inputs, including electricity, from outside the region in which their production facilities are located. In such cases, the local impacts of electricity generation and of changes in the demand for electricity may be relatively small.

The size of the direct and secondary impacts from changes in the level of activity in the electricity sector is also related to the importance of electricity as a factor input to regional industries. Because some industries are much more energy intensive than others, the magnitude of impacts and therefore the size of direct and secondary effects vary accordingly. For example, areas dominated by energy production activities, in which local electricity generators provide the major local market, are likely to experience substantial changes in their economies, with less demand for electricity. In such a case, the local economy is unlikely to find alternative markets for energy in the short term, as changes occur in the demand for coal from electric utilities.

Changes in hydropower operations also result in changes in the generation, sale, and trade of electricity in the economy of each of the nine subregions. These adjustments produce secondary impacts as the electricity sector adjusts to losses in power previously purchased from Western. These secondary impacts primarily affect non-Western (IOU) generation and appear in the form of changes in demand for the production of fossil fuel, transportation, and capital equipment as generation and transmission capacity is added. In the EIS, however, it is assumed that secondary impacts are likely to be much less significant than impacts from changes in prices. Secondary impacts arising from changes in generation are not included

in the estimation of impacts in the EIS and are therefore not discussed in this technical memorandum.

4.2 CHOICE OF METHODS FOR THE ANALYSIS OF REGIONAL ECONOMIC IMPACTS

Econometric analysis and input-output analysis are the most commonly used approaches to estimating the regional economic impacts of given changes in policy on the economy of an area. Both methods have been used to generate impact information for a range of policy programs and industrial development strategies.

An econometric analysis of the regional economic impact of changes in electricity prices models the major industries or sectors that form the economic base of the region in which impacts are to be estimated. The level of sectoral disaggregation possible is highly dependent on adequate data being available for the regions to be modeled. These industries are then used as the basis of the impact analysis and the forecasts for the impact scenarios. Although econometric models have been constructed for individual states, few econometric models provide regional or multiregional information. One system that has this capability is the Data Resources Inc. (DRI) model. The DRI model is essentially a macroeconomic econometric forecasting model based on national data that can be disaggregated into regional and state components. The model produces quarterly forecasts of employment, income, wages, and salaries in 20 major industrial sectors. Within manufacturing, productivity forecasts are available for 50 sectors. A range of economic and demographic activity variables can also be forecasted, including population, housing starts, personal consumption expenditures, regional price indexes, residential and nonresidential investment, labor force participation rates, unemployment, retail sales, and state and local taxes. Long-term forecasts include predictions through 2015.

The main problem with econometric approaches to estimating the impacts of changes in policy is that they do not take into account the complex interrelationships that exist among sectors in most regional economies. This lack casts some doubt on the accuracy of impact analyses based on econometric analysis and the value of forecasts made by using econometric models. Not only are sectors connected, through purchases and sales between them; they are connected indirectly as they serve as intermediaries, purchasing and selling output to other sectors. For example, the construction of a new power plant requires large amounts of capital equipment to be purchased from electrical and mechanical engineering firms. These firms, in turn, purchase inputs from other engineering and metals sectors, which also, in turn, buy inputs from other sectors. The complexity of these linkages in any particular economy depends on the size and level of diversification of the economy for which the impacts are being measured. Without the explicit specification of interindustry structure, therefore, it becomes very difficult to fully estimate the direct and indirect effects of changes in output in any of the sectors in the economy. Incorporating the interindustry structure of each region requires the use of input-output data in which the interindustry structure of the region is explicitly specified and indirect effects can be adequately measured.

The nature of the affected area as a large group of counties in seven states, and the potential need to examine impacts at the county level, also influenced the choice of impact methodology. Input-output models at the county and multicounty (regional) level, based on regionalized national data, have become readily available and have become an essential part of sectoral impact analysis of changes in a range of exogenous policy variables. Econometric models, on the other hand, have focused on modeling changes in the macroeconomy and have not made such rapid progress toward being tools for regional impact analysis at the microscale.

Input-output analysis has been used extensively by regional analysts, planners, and consultants to estimate a range of regional, state, and county impacts. Public policymakers have used input-output data to assess the effects of changes in spending patterns that affect prominent regional industries, changes in regional fiscal or energy policies, and changes in military spending. Private sector uses for the data include assessment of the effects of industrial expansion and contraction on the remaining sectors in the economy. Measurement of backward (demand-side) and forward (supply-side) effects has aided industries in evaluating the nature of market potential, given various exogenous changes in activity. Conventional input-output models are used to estimate the local impacts of changes in expenditures on output, income, and employment on an industry-by-industry basis. A full description of input-output analysis, including assumptions, data, and applications, can be found in Miller and Blair (1986).

4.3 DESCRIPTION OF REGIONAL ECONOMIC IMPACT MODELS

4.3.1 Introduction

Ideally, an input-output system is based on a table of transactions between sectors collected from surveys of samples of individual industries in each sector in an economy. However, although an increasing number of models rely on primary data collected from surveys, the time needed to collect and present the data and the expense involved in surveying representative firms from even a relatively small number of sectors often precludes their more widespread development. To date, survey-based regional models exist only for two states, Washington and Kansas, and none have been developed at the county level. Analysis at the regional level, therefore, relies on nonsurvey regional models estimated from survey data collected at the national level, which can then be "regionalized" or calibrated to the regional unit being modeled by using standard regional data on wages, salaries, and employment, to accurately reflect regional patterns in economic structure and trade.

A number of commercially available nonsurvey input-output models can be used for the estimation of changes in electricity rates. Although the data used in these models are based on the regionalization of national input-output data, each model is sensitive to local economic conditions and can be used to forecast with high levels of confidence. The REMI system was chosen to estimate the economic and demographic impacts of changes in electricity rates in the nine subregions, and the IMPLAN system was chosen for the analysis

of impacts in the two high-reliance counties and on low-income households in the nine subregions.

4.3.2 Description of the REMI Modeling Framework

The REMI model provides estimates of economic and demographic impacts of changes in economic development and other policy variables through a combination of input-output and econometric methods. Forecasts of impact scenarios are also provided. Although the REMI system uses econometric techniques, it has a major advantage over simple econometric models in that it uses the theoretical structural restrictions implied in the input-output accounts instead of econometric estimates based on single time-series observations for single regions. The combination of input-output and econometric techniques in the model allows the use of policy variables that represent a range of policy options and the tracking of their effects on a range of variables throughout each forecast period.

The REMI system assumes many of the characteristics of computable general equilibrium models, which are increasingly used at the regional level. The system includes data on price-responsive product and factor demand and supplies, and it is predicated on the assumption of equilibrium in all product and factor markets. The dynamic version of the REMI model assumes either perfect-foresight market clearing over time or temporary market clearing if expectations are imperfect. Unlike other models, the REMI system does not assume that product and factor markets clear continuously. Instead, responses between variables over time are determined through the combination of a given model structure with econometrically estimated parameters.

The core of the REMI model is an input-output structure representing interindustry linkages and linkages to final demands for 53 individual industry groupings. In addition to the basic input-output structure, the model also includes substitution between factors of production in response to changes in relative factor costs, migration in response to changes in expected income, wage responses to changes in labor market conditions, and changes in the share of local and export markets in response to changes in regional profitability and production costs.

The REMI model has five parts (Figure 3). Output linkages or input-output accounts represent the core of the model, which shows interindustry linkages and endogenous final demand. The standard REMI model is based on a 53-sector model of the U.S. economy, regionalized through the use of location quotients to produce interindustry tables at the subregional level. Final demand includes 25 sectors. Also included is an occupational matrix of 94 occupational groups that provides output on likely changes in occupational structure given any change in final demand in each county economy. Within this matrix, 202 age/sex cohorts give additional information on the demographic impacts of changes in exogenous expenditures.
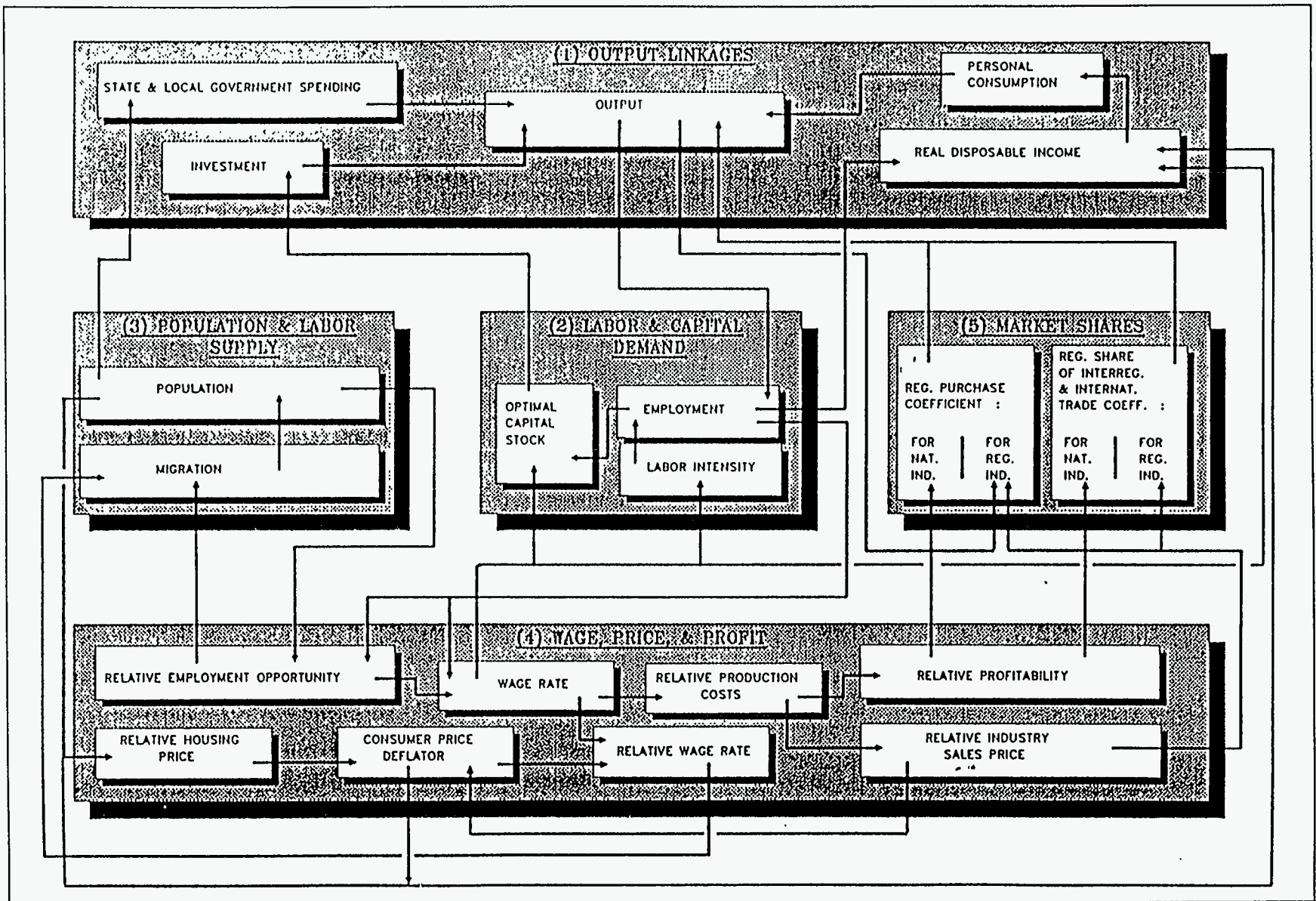
FIGURE 3 Structure of the REMI Modeling System (Source: Treyz 1992)

The interindustry section of the model is linked to an econometric model with four distinct blocks, and there are extensive linkages between each block. Outputs in the input-output block drive labor demand (block 2), and labor demand interacts with labor supply to determine wages (block 3). In tandem with other factor costs, wages determine relative production costs and relative profitability (block 4), which, in turn, affect market shares (block 5). The market shares block models the proportion of local demand and exogenous export demand in the region that is filled by local production (block 1).

Endogenous final demands (block 1) include consumption, investment, and state and local government demand. Real disposable income drives consumption demands. Nominal disposable income is derived as wage income (blocks 2 and 4) combined with property income related to population calculated (block 3), plus transfer income related to population minus employment and retirement population, minus taxes. Real disposable income comes from nominal disposable income deflated by the regional consumer price deflator (block 4). Optimal capital stock (block 3) determines state and local final demand, and the endogenous final demands combined with exports drive the outputs (block 1).

Detailed descriptions of the components of each major block, including their theoretical basis, estimation methodologies, and a more detailed discussion of linkages, can be found in Treyz et al. (1992) and Treyz (1993). An evaluation of the performance of the REMI system can be found in Cassing and Giarratani (1992).

The REMI system has been used to estimate the impacts of a large number of economic development initiatives (new public and private facilities and existing facility expansions), econometric and demographic forecasts (occupational, wage rate, and export base forecasts), transportation policy, environmental and natural resource policies (air quality regulations and changes in electricity energy and other costs), and fiscal policies (changes in tax rates and in military spending). Descriptions of various applications of the REMI system can be found in Treyz (1981, 1993), Kahn et al. (1987), Employment Research Associates (1988, 1990), and Weisbrod and Beckwith (1992).

4.3.3 Description of the IMPLAN Modeling Framework

The impacts of changes in retail rates in the two high-reliance counties on household income groups in the nine subregions are estimated by using the IMPLAN input-output modeling system. The IMPLAN input-output modeling system was developed by the U.S. Forest Service and the Department of Agriculture and Applied Economics at the University of Minnesota. The core of the IMPLAN model is the 537-sector 1985 national input-output table. Control totals for the region under consideration are then estimated by IMPLAN, and the national table of direct requirements is used to provide regional transaction tables. Calculation of the control totals incorporates use of four-digit *County Business Pattern* data on the number of firms by employee size class, together with earnings data from the two-digit Regional Economic Information System, to develop estimates for employment and income in the industrial sectors. The proportion of outputs coming from imports in each region is estimated by using data from the Jack Faucett and Associates

Multiregional Input-Output system, which details state-level input, output, and trade arrangements.

The IMPLAN model can be used to produce data on output, income, and employment impacts resulting from any change in final demands from a single sector or a series of sectors in the economy in question. The IMPLAN model provides sufficient mathematical detail to allow the basic model to be modified for additional applications, such as the analysis of household income impacts. A full discussion of the IMPLAN modeling framework can be found in Minnesota IMPLAN Group (1994). Summaries of the various applications of the IMPLAN model can be found in Rose et al. (1988) and Crihfield and Campbell (1991). Although the IMPLAN system and REMI framework have some small differences related to the data they use for regionalizing national data, the multiplier estimates produced by the two modeling systems are very similar. Use of the IMPLAN system does not, therefore, pose any problems in consistency with the remainder of the regional analysis. Crihfield and Campbell (1991) compares the two modeling approaches.

4.3.4 Modifications to IMPLAN for the Measurement of Impacts on Low-Income Households

The measurement of income distributional impacts by using IMPLAN focuses on the disaggregation of the household and consumption sectors of the standard input-output table by using data from the U.S. Bureau of Labor Statistics, the New York Stock Exchange, and the Internal Revenue Service. The result is a series of income accounts showing information on the sectors and income brackets of recipients and of consumers. These data are then regionalized for each of the nine subregions used in the analysis. Household income impacts are calculated by using total changes in electricity expenditures in each region together with changes in gross output for each sector that result from changes in electricity prices. A full explanation of the methods used to estimate income distribution impacts and a description of the data and assumptions used can be found in Rose and Frias (1993).

The methodology chosen to measure income distribution impacts in the EIS has been used on numerous occasions for analysis at the regional level, in particular for the analysis of the income distribution impacts of natural resource utilization programs. Recent examples include the analysis of the impact of surface mining activity in heavily forested areas in Appalachia (Rose et al. 1988) and of strategies that affect fish migration and hydropower-irrigation trade-offs in the Columbia River Basin (Wernstedt 1991).

4.4 DESCRIPTION OF INPUT DATA ESTIMATION PROCEDURES

4.4.1 Introduction

The regional economic impact analysis estimated the impact of changes in electricity rates resulting from Western's marketing alternatives and supply options on commercial and industrial electricity rates as well as expenditures on electricity for the economies of the nine subregions in the Western service territory. To estimate these impacts at the subregional level, changes in retail prices and expenditures on electricity at the level of the individual customer utility were converted to changes at the subregional level. This procedure involved calculating the proportion of power sales to industrial, commercial, and residential customers coming from Western and from non-Western sources for each county in the affected region. Shares at the county level were then aggregated to the subregional level to give the proportion of electricity sales coming from Western for each of the subregions. These shares were used to calculate changes in prices and expenditures on electricity for each customer class, which were then used as input to the REMI and IMPLAN models.

This section describes the procedure used to translate utility-level price changes to price changes for each subregion for each marketing alternative and supply option. A brief discussion of the data inputs used for the REMI and IMPLAN modeling frameworks is then provided.

4.4.2 Input Data Estimation Procedures

The analysis of financial and rate impacts (Bodmer et al. 1995) provided revenue and quantity information on four different customer classes: residential, commercial, industrial, and other. These utility-level data for each Western customer were then translated into regional-level data to provide input for the REMI and IMPLAN modeling systems. The regionalization procedure was complicated by the fact that non-Western utilities also sell power in each of the subregions, and sales by these utilities affect subregional prices. In addition, each of the subregions is served by more than one utility, and a number of utilities serve two or more different regions. Thus, the sales of these utilities had to be divided among the subregions they serve. A further complication was the fact that customers of different customer classes are generally not distributed evenly across the service territory of each utility.

Because the regional impact analysis was undertaken for regions that were combinations of counties, the translation of utility-level data to regional-level information focused on disaggregating utility sales to the county level and then aggregating sales from the county level to the regional level. This disaggregation was undertaken for each customer class in each utility that sells power in the region. The first step in the process was to identify all utilities, both Western and non-Western customers, that sell electricity in the Western service territory by using information taken from the 1991 EIA Form 861. The method used to identify the counties served by each utility is described in Section 3.

Once the counties served by a particular utility were identified, utility sales were then allocated to each county served. An allocation procedure was used because customers in different customer classes are not uniformly distributed across utility service territories. Assumptions were that there was universality of electric service and that the number of households in a county could be used as a proxy for the number of residential customers in that county. The number of business establishments in each county was used as a proxy for the number of commercial and industrial customers. Household data were taken from the Census of Population (U.S. Bureau of the Census 1987), and business establishment data by SIC in each county were taken from *County Business Patterns* (U.S. Department of Commerce 1990). Because utilities classify their customers according to the types of service they require, and business establishments with large energy and capacity requirements are classified as industrial customers, there was a problem in classifying business establishments across the SIC categories used in the census data. The problem was dealt with by allocating customers between commercial and industrial consumer classifications. Establishments with two-digit SIC numbers of 20-49 were classified as industrial customers, and those with other two-digit SIC numbers were classified as commercial customers.

The utility-level customer data and the county-level household and business establishment data were aggregated to the state level and then compared to determine how well the proxy data performed. The comparison revealed that there tended to be more residential customers than households in a state, although customers exceeded households by only 3-6%. Consequently, the number of households seemed to be a reasonable proxy for the number of residential customers. The comparison also showed that in most states, there were 50-70% more commercial and industrial customers than business establishments. This finding is not necessarily problematic, however, because many business establishments are provided with more than one electricity service. This situation could lead to large differences between utility data and the census data, however, because utilities usually count customers by the number of meters used in providing service. Some business establishments might also have multiple locations, each requiring separate electric service.

Despite the apparent performance deficiencies, the proxy data were used as the basis for allocating customers of particular utilities to the counties they served. Because the number of households and business establishments did not exactly match the number of customers on the state level, however, correction factors were calculated from the state totals to augment the number of households or business establishments in each county to a level that would lead to the correct statewide total number of customers. Thus, if there were 5% more customers than households statewide, the number of customers in each county was assumed to be 5% more than the number of households indicated by the census data. Use of correction factors in this manner assumes a uniform relationship between households and customers across the state. Although such an assumption may not be valid because urban areas are more likely to have a higher customer-to-household ratio than rural areas, the assumption simplified the analysis.

On the basis of these assumptions, customers were allocated to counties by using the household and business establishment data until each utility and each county had the correct

number of customers. When there were too many or too few customers in a particular county, it was assumed that a non-Western utility was selling power in the county, and the necessary adjustments were made to the allocation algorithm. The final customer allocations at the county level were then aggregated to the subregional level. This procedure produced an allocation matrix for each customer class, with the utilities as rows and the regions as columns; the elements in each matrix were the number of customers that a utility serves in that region. The matrices for each subregion were then used to translate utility-level information into subregional information; the units in the input information conformed to the units of the allocation matrix. For example, to translate residential revenue from the utility level to the subregional level, the data were initially expressed as the ratio of residential revenue to the total number of residential customers at the utility level. Multiplication by the allocation matrix then yielded a vector of residential revenues whose elements were the residential revenues for each subregion. Appendix B explains the procedure in more detail.

In some parts of the region in which Western markets electricity, there will be substantial changes in the wholesale rates charged to some Western customer utilities, given the importance of their purchases from Western. Since a large number of the customer utilities that would experience large impacts have small local service territories, the impacts are likely to be highly localized in nature. However, the purpose of the regional impact analysis was to measure the impact of changes in Western rates on the economies of the nine subregions as a whole rather than to attempt to measure the impacts at the individual county or utility level. Accordingly, changes in retail rates charged by Western's customer utilities were combined with rates charged by all other non-Western utilities to produce an overall change in rates in each subregion. Consequently, changes in retail rates at the regional level due to changes in Western power are likely to be much smaller than those at the utility level, given the size of Western power sales compared with total power sales in each of the subregions.

4.4.3 Input Data for the REMI and IMPLAN Models

The REMI model was used to assess the impacts of changes in electricity rates caused by changes in commercial and industrial rates and changes in residential expenditures on electricity in each of the subregions. The consequent direct and secondary impacts on population, GRP, disposable income, and employment were then examined. The IMPLAN model was used to estimate the impacts of changes in electricity rates in the two high-reliance counties and on lower income households through the effect of changes in total expenditures on electricity in each of the subregions. The consequent direct and secondary impacts on households in 11 household income groups were then evaluated. Tables 13, 14, and 15 show the input data used in the REMI and IMPLAN models to measure the regional economic impacts of alternative 5C. The numbers in the tables reflect the impact of the alternative, including estimates of annual growth demand rates for each utility and estimates of annual rates of inflation. Changes in expenditures (Table 13) are in current dollars; changes in commercial and industrial rates are in percentages (Tables 14 and 15). The

TABLE 13 Changes in Residential Expenditures on Electricity (10^6 $): Alternative 5C

Subregion[a]	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
1	0.59	0.58	0.57	0.55	0.55	0.54	0.52	0.53	0.41	-0.18	-0.41	0.12	0.65	0.90	0.19	-0.14
2	6.12	7.89	8.18	6.95	5.28	5.10	5.08	-0.73	0.93	0.90	-2.05	-1.60	-3.73	-5.60	-3.98	-3.91
3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4	0.55	0.52	0.72	0.88	1.03	1.08	1.11	1.12	1.15	1.18	1.27	1.32	1.24	1.21	1.31	1.23
5	4.11	4.29	4.39	4.55	4.72	1.99	1.78	1.61	1.32	1.23	-0.97	-0.68	-3.39	1.64	2.10	1.37
6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7	3.61	3.58	3.57	2.76	2.65	2.63	2.75	1.88	2.01	2.09	1.84	1.87	1.44	1.41	1.42	1.46
8	4.99	4.93	5.61	5.62	6.03	5.62	6.18	-2.63	-0.20	-0.53	-3.46	-3.76	-8.39	-9.69	-11.48	-13.72
9	15.20	14.57	14.69	14.48	14.43	11.94	14.54	5.00	6.97	6.54	2.42	2.54	-2.72	0.68	0.00	-1.72

[a] 1 = Arizona Metropolitan Subregion, 2 = Colorado Metropolitan Subregion, 3 = Nevada Metropolitan Subregion, 4 = New Mexico Metropolitan Subregion, 5 = Utah Metropolitan Subregion, 6 = Wyoming Metropolitan Subregion, 7 = High Plains Subregion, 8 = Rocky Mountain Subregion, 9 = Great Basin Subregion.

TABLE 14 Percentage Changes in Commercial Electricity Rates by Subregion: Alternative 5C

Subregion[a]	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
1	0.18	0.17	0.16	0.16	0.15	0.15	0.14	0.14	0.13	0.09	0.08	0.11	0.13	0.14	0.10	0.09
2	0.94	1.21	1.22	1.02	0.73	0.70	0.66	0.19	0.31	0.29	0.02	0.10	-0.01	-0.17	0.07	0.13
3	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04
4	0.14	0.13	0.17	0.21	0.24	0.25	0.25	0.25	0.25	0.26	0.28	0.28	0.27	0.26	0.27	0.25
5	2.72	2.83	2.82	2.88	2.92	1.75	1.65	1.58	1.40	1.36	0.56	0.57	-0.31	1.36	1.38	1.09
6	0.16	0.16	0.16	0.10	0.10	0.09	0.09	0.10	0.08	0.09	0.09	0.09	0.09	0.11	0.11	0.12
7	1.44	1.35	1.29	1.02	0.93	0.91	0.90	0.82	0.78	0.78	0.75	0.75	0.71	0.70	0.71	0.71
8	3.10	2.99	3.05	2.88	2.89	2.71	2.84	0.15	0.88	0.83	0.03	-0.05	-1.15	-1.43	-1.71	-2.05
9	5.59	5.02	4.82	4.58	4.35	3.39	4.18	2.37	2.42	2.25	1.50	1.49	0.71	1.61	1.68	1.49

[a] 1 = Arizona Metropolitan Subregion, 2 = Colorado Metropolitan Subregion, 3 = Nevada Metropolitan Subregion, 4 = New Mexico Metropolitan Subregion, 5 = Utah Metropolitan Subregion, 6 = Wyoming Metropolitan Subregion, 7 = High Plains Subregion, 8 = Rocky Mountain Subregion, 9 = Great Basin Subregion.

TABLE 15 Percentage Changes in Industrial Electricity Rates by Subregion: Alternative 5C

Subregion[a]	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
1	0.17	0.16	0.16	0.15	0.15	0.15	0.14	0.14	0.13	0.11	0.11	0.12	0.14	0.15	0.12	0.11
2	13.30	14.38	14.22	12.79	11.32	10.96	10.55	8.45	8.79	8.54	7.26	7.38	6.82	6.00	6.81	6.90
3	1.58	1.58	1.58	1.58	1.58	1.58	1.58	1.58	1.58	1.58	1.58	1.58	1.58	1.58	1.58	1.58
4	0.91	1.00	1.10	1.21	1.33	1.45	1.57	1.72	1.85	2.00	2.17	2.33	2.50	2.67	2.86	3.04
5	0.74	0.77	0.77	0.79	0.80	0.60	0.59	0.58	0.55	0.54	0.40	0.39	0.23	0.55	0.55	0.49
6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7	1.37	1.30	1.47	1.46	1.55	1.57	1.57	1.54	1.51	1.52	1.56	1.58	1.48	1.43	1.50	1.42
8	3.05	2.95	3.01	2.87	2.87	2.84	2.88	1.92	2.08	1.76	1.43	1.64	1.47	1.45	1.06	0.79
9	5.26	4.98	4.82	4.64	4.47	4.26	4.64	3.51	3.63	3.52	3.21	3.14	2.83	2.91	2.80	2.67

[a] 1 = Arizona Metropolitan Subregion, 2 = Colorado Metropolitan Subregion, 3 = Nevada Metropolitan Subregion, 4 = New Mexico Metropolitan Subregion, 5 = Utah Metropolitan Subregion, 6 = Wyoming Metropolitan Subregion, 7 = High Plains Subregion, 8 = Rocky Mountain Subregion, 9 = Great Basin Subregion.

regional impact analysis considered the impact of changes in the overall level of rates to industrial and commercial customers and changes in electricity expenditures in each of the subregions. In addition to changes in Western hydropower operations, therefore, the input data also took into account the impacts on subregional electricity rates and expenditures on electricity purchases and additions to capacity from non-Western sources needed to meet electricity supply shortfalls that occur under most of the alternatives (Table 1).

A 53-sector economic-demographic forecasting and simulation REMI model was provided for each of the nine subregions for the year 1990. Simulations were performed by using 1992 as the base year and 1993 as the first year in which impacts would occur from each of the alternatives. The REMI models were used to provide forecasts of the baseline and impacts of each alternative in each region. Simulations to project the baseline and impact of each alternative for each subregion were performed separately for each year from 1993 to 2008. Because the analysis of the regional impacts of each alternative used detailed yearly data on the rate impacts of each alternative, the regional impacts were also estimated on a year-by-year basis. Cumulative impacts of each alternative were therefore not included in the analysis.

An 83-sector IMPLAN model was constructed for each of the nine subregions for the year 1990. The models were updated to 1992 to provide a base year for each region and forecasted to 1993, 2000, and 2008 by using data on growth rates in income, GRP, employment, and population generated by the REMI system for each region and forecasts in the annual rate of inflation produced by DRI.

4.4.3.1 Changes in Commercial and Industrial Electricity rates

The impact of each commitment-level alternative on the cost of doing business in each subregion for each alternative and supply option was estimated by changing the commercial and industrial electricity rates in the REMI models for each subregion. These price changes were introduced as percentage changes over the baseline for both customer classes for each subregion, for each year in the forecast period 1993-2008 (Tables 13 and 14).

4.4.3.2 Changes in Household Expenditures on Electricity

The impact of each commitment-level alternative on household expenditures (changes in the consumer price index) in each subregion for each alternative and supply option was estimated by calculating the change in residential expenditures (real disposable income) resulting from changes in residential electricity rates. Changes in residential expenditures were then introduced into the REMI model for each subregion as changes in millions of nominal dollars, for each year in the forecast period 1993-2008 (Table 13).

4.4.3.3 Impacts on Low-Income Groups

The impact of each commitment-level alternative and supply option on low-income households in each subregion for each alternative and supply option was estimated by using the changes in total expenditures on electricity for all customer classes (industrial, commercial, and residential) in each subregion. These changes were then combined with final demand information in the IMPLAN model for each subregion to calculate new final demand vectors. Information on the distribution of income across households was combined with input-output information for each subregion to calculate the impacts of each alternative on households with less than $30,000 per year for 1993, 2000, and 2008. The estimation procedure is described in more detail in Rose and Frias (1993).

4.4.3.4 Impacts on High-Reliance Counties

The impact of each commitment-level alternative and supply option in the two higher reliance counties was expressed in terms of changes in total expenditures on electricity for all customer classes combined with data on final demand for all industries in each county from the IMPLAN model. Impact on output, income, and employment were then calculated for the year 1993.

5 REGIONAL ECONOMIC IMPACTS OF COMMITMENT-LEVEL ALTERNATIVES

5.1 INTRODUCTION

In some parts of the region in which Western markets electricity, it is clear that changes in Western's commitment levels could lead to substantial changes in wholesale rates for Western customer utilities. The magnitude of these changes in wholesale rates would depend on the volume of power purchases from Western. Changes in retail rates charged by Western customers, in turn, have the potential to affect the level of economic activity and consequently the growth prospects in each subregion in future years.

Specifically, higher electricity rates could cause an increase in the cost of doing business that could, in turn, lead to (1) a decline in competitiveness in products made by industries within each subregion and (2) the substitution by customers of products made outside the affected region for locally produced items. In extreme cases, rate increases could create an incentive for some businesses to move out of the affected region, or they could discourage new businesses from moving in. Both effects would adversely affect employment and income as well as GRP. As higher electricity rates consequently change the geographic distribution of employment opportunities, population growth and inward migration could be discouraged. The magnitude of these possible effects would depend on the importance of electricity prices in production decisions made by businesses as well as in locational decisions made by households. Existing industrial location research suggests that threshold levels of changes must be exceeded before such impacts would occur (Calzonetti et al. 1991).

In addition to impacts due to changes in electricity prices and in expenditures arising from each commitment-level alternative, secondary impacts also arise from changes in the source of electricity supplies that affect other industries in each subregion. Although the impacts of expansion in production to meet the shortfall in Western electricity production in each subregion lead to gains in GRP, disposable income, employment, and population, the size of the increase in electricity output needed to offset the shortfall in supplies from Western means that these impacts are relatively small. Analysis of impacts arising from changes in non-Western electricity production in each subregion shows that these impacts only partially offset the impacts of price increases. The measurement of impacts due to changes in electricity prices in each subregion therefore overestimates the size of these impacts.

5.2 ANALYSIS OF IMPACTS BY COMMITMENT-LEVEL ALTERNATIVE

Even though the impacts of rate changes arising from changes in commitment-level alternatives are relatively small in each of the subregions, a more detailed description of the geographic nature of these impacts is still appropriate. This description will facilitate a more detailed evaluation of commitment-level alternatives. This section reports in more detail the results of the regional economic analysis for the key variables that were used to measure the

potential impacts of a change in rates. These are population, GRP, disposable income, and employment. The data for these variables are provided for the three years 1993, 2000, and 2008. The data on population, GRP, disposable income, and employment impacts for the no-action and other six alternatives are discussed in Sections 5.2.1 through 5.2.7. The analysis of regional impacts undertaken for the EIS used 1992 as the base year and 1993 as the first year in which impacts were likely to occur. Estimates for 1993 are therefore included in the tables to show the impact of each alternative in each region over the entire forecast period. The impacts of changes in Western's commitment levels on households in the affected region with annual incomes of less $30,000 are also discussed in Sections 5.2.1 through 5.2.7 under each alternative.

The impacts of alternatives 1, 3, and 6 on population, GRP, disposable income, household income, and employment were based on interpolating between estimates of impacts produced by the no-action alternative and alternatives 2, 4, and 5. Because of the large number of combinations of alternatives and supply options, the analysis of impacts concentrated on those scenarios that were likely to produce the maximum and minimum rate impacts, together with a middle point. The choice of alternatives was based on information generated by the SLCA/IP Power Alternative Screening Method (SPASM). Justification for this approach can be found in Sabo (1992). A description of the modeling procedure can be found in Palmer and Ancrile (1995).

Multivariate regression was used to provide interpolated estimates of regional impacts for those scenarios not included in the REMI modeling (i.e., alternatives 1, 3, and 6). A regression equation was then set up, with power commitment and energy commitment as the independent variables and percent change from the baseline for five factors (population, GRP, disposable income, household income, and employment) as the dependent variables. (A brief outline of each of the alternatives is provided in Table 1). Coefficients for each alternative and supply option were then calculated, and the results were used to estimate values for the three alternatives not included in the REMI modeling.

In addition to the impact on aggregate economic activity in each subregion, electricity rate increases may also differentially affect activity in specific sectors. Analysis of the effects of changes in rates on employment in specific manufacturing and service industries, however, did not reveal significant impacts on total employment in any of the subregions. No attempt is made, therefore, to discuss the sectoral impacts of the commitment-level alternatives.

The following section describes the estimates of the impacts of each alternative and supply option for the nine subregion. This description is followed by a discussion of the impact of each commitment-level alternative and supply option in the high-reliance counties. Because none of the results were found to be statistically different from zero, the discussion is limited to describing the estimates for those subregions in which the impacts were the largest.

5.2.1 No-Action Alternative — Pre-1989 Marketing Criteria

The no-action alternative would produce very small negative changes in economic activity; most of the impacts would be less than 0.1% different from the baseline in each of the nine regions (Table 16). For each of the variables considered under this marketing alternative, the largest impacts would occur in the Colorado Metropolitan Subregion. In this subregion, supply option B would produce impacts of no more than −0.02% on population, disposable income, and employment in both 2000 and 2008; the impact on GRP would be −0.02% in 2000 and −0.03% in 2008. Smaller impacts would occur in the Utah Metropolitan, Rocky Mountain, and Great Basin Subregions, although these would be minimal, at either −0.01 or −0.02% in each year for each variable.

The impacts of supply option C would be somewhat larger in absolute terms in each of the regions; the largest impacts would again occur in the Colorado Metropolitan Subregion (Table 17). Here, the largest impact would be on GRP, with changes of up to −0.19% in 2000 and −0.20% in 2008. Other changes would range from −0.12% to −0.15%, with larger changes coming at the end of the forecast period in 2008. Smaller changes under supply option C would occur in the Utah Metropolitan, Rocky Mountain, and Great Basin Subregions; most changes would be less than −0.10% for each variable. Disposable income would show the largest impacts: changes of −0.11% in the Utah Metropolitan and Great Basin Subregions and −0.12% in the Rocky Mountain Subregion.

The impact of the no-action alternative on households with annual incomes of less than $30,000 would be the largest in the Great Basin Subregion in 1993, where 0.35% of households would experience a decrease in income of more than $500 per year under supply option C in 1993 (Table 17). No impacts would occur in this region in 2000 or 2008. Smaller impacts of the no-action alternative would occur in the High Plains Subregion under supply option C, where 0.30 and 0.29% of households would experience a decrease in income of more than $500 per year in 2000 and 2008, respectively. More than 99.5% of households with annual incomes of less than $30,000 would experience a decrease in income of less than $500 per year for any of the three scenarios under the no-action alternative.

5.2.2 Commitment-Level Alternative 1 — Post-1989 Marketing Plan

The impact of alternative 1 in each subregion would be more varied than the impact of the no-action alternative (Table 18). Supply option A would produce positive impacts in most of the subregions, while supply options B and C would generally lead to negative economic impacts in each of the subregions. If alternative 1 were to be the preferred course of action, the largest impacts under supply option A would occur in the Great Basin Subregion, with a change of 0.09% in disposable income in 2008. The largest impacts on population, GRP, and employment in the Great Basin Subregion would be 0.05% in 2008. Smaller changes as a result of supply option A would occur in the Colorado Metropolitan, Utah Metropolitan, and Rocky Mountain Subregions. The largest of these would again be

TABLE 16 Estimated Impacts on Population, GRP, Disposable Income, and Employment[a]: No-Action Alternative

Subregion[b]	Supply Option	Population			GRP			Disposable Income			Employment		
		1993	2000	2008	1993	2000	2008	1993	2000	2008	1993	2000	2008
1	B	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	C	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	B	0.00	-0.01	-0.02	-0.01	-0.02	-0.03	-0.01	-0.02	-0.02	-0.01	-0.02	-0.02
	C	-0.02	-0.12	-0.13	-0.08	-0.19	-0.20	-0.09	-0.15	-0.14	-0.07	-0.14	-0.13
3	B	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	C	0.00	0.00	-0.01	0.00	-0.01	-0.01	0.00	-0.01	-0.01	0.00	0.00	-0.01
4	B	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	C	-0.02	-0.02	-0.02	-0.01	-0.02	-0.02	-0.02	-0.02	-0.02	-0.01	-0.01	-0.02
5	B	0.00	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	0.00
	C	0.00	-0.09	-0.07	-0.06	-0.08	-0.06	-0.11	-0.12	-0.07	-0.06	-0.07	-0.03
6	B	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	C	0.00	0.00	-0.01	0.00	0.00	0.00	0.00	0.00	-0.01	0.00	0.00	0.00
7	B	0.00	-0.01	-0.01	0.00	0.00	0.00	-0.01	-0.01	-0.01	0.00	-0.01	0.00
	C	-0.01	-0.05	-0.06	-0.05	-0.04	-0.04	-0.07	-0.07	-0.07	-0.05	-0.04	-0.04
8	B	0.00	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.05	-0.01	-0.01	-0.01
	C	-0.02	-0.08	-0.08	-0.05	-0.07	-0.07	-0.11	-0.12	-0.10	-0.05	-0.07	-0.06
9	B	0.00	-0.01	-0.01	-0.01	-0.01	-0.01	-0.02	-0.02	-0.01	-0.01	-0.01	-0.01
	C	-0.02	-0.08	-0.07	-0.05	-0.07	-0.06	-0.12	-0.11	-0.09	-0.05	-0.06	-0.04

[a] The data were estimated by the REMI modeling system.

[b] 1 = Arizona Metropolitan Subregion, 2 = Colorado Metropolitan Subregion, 3 = Nevada Metropolitan Subregion, 4 = New Mexico Metropolitan Subregion, 5 = Utah Metropolitan Subregion, 6 = Wyoming Metropolitan Subregion, 7 = High Plains Subregion, 8 = Rocky Mountains Subregion, and 9 = Great Basin Subregion.

TABLE 17 Estimated Impacts of Commitment-Level Alternatives and Supply Options on Households with Annual Incomes of Less than $30,000

Subregion	Supply Option	No Action			Alternative 1			Alternative 2			Alternative 3		
		Percentage of Households Experiencing Decrease in Income of More Than $500 per Year											
		1993	2000	2008	1993	2000	2008	1993	2000	2008	1993	2000	2003
Arizona	A	---	---	---	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Metropolitan	B	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	C	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Colorado	A	---	---	---	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Metropolitan	B	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	C	0.11	0.04	0.00	0.13	0.04	0.00	0.04	0.00	0.00	0.05	0.01	0.00
Nevada	A	---	---	---	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Metropolitan	B	0.00	0.00	.000	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	C	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
New Mexico	A	---	---	---	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Metropolitan	B	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	C	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Utah	A	---	---	---	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Metropolitan	B	0.00	0.00	0.00	0.00	0.00	0.02	0.05	0.05	0.00	0.00	0.00	0.01
	C	0.11	0.00	0.00	0.01	0.01	0.02	0.11	0.10	0.00	0.03	0.03	0.01
Wyoming	A	---	---	---	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Metropolitan	B	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	C	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
High Plains	A	---	---	---	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	B	0.00	0.00	0.00	0.08	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00
	C	0.25	0.30	0.29	0.27	0.35	0.28	0.25	0.18	0.17	0.25	0.19	0.20
Rocky Mountain	A	---	---	---	0.10	0.13	0.13	0.00	0.00	0.00	0.04	0.05	0.05
	B	0.00	0.00	0.00	0.04	0.00	0.09	0.00	0.00	0.00	0.00	0.00	0.03
	C	0.12	0.12	0.00	0.21	0.11	0.05	0.12	0.00	0.00	0.10	0.03	0.02
Great Basin	A	---	---	---	0.14	0.32	0.33	0.00	0.00	0.00	0.14	0.13	0.13
	B	0.00	0.00	0.00	0.08	0.21	0.25	0.00	0.00	0.00	0.13	0.11	0.10
	C	0.35	0.00	0.00	0.28	0.21	0.25	0.19	0.00	0.00	0.32	0.11	0.10

TABLE 17 (Cont.)

Percentage of Households Experiencing Decrease in Income of More than $500 per Year

Subregion	Supply Option	Alternative 4			Alternative 5			Alternative 6		
		1993	2000	2008	1993	2000	2008	1993	2000	2008
Arizona Metropolitan	A	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	B	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	C	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Colorado Metropolitan	A	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	B	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	C	0.00	0.00	0.00	0.08	0.00	0.00	0.07	0.01	0.00
Nevada Metropolitan	A	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	B	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	C	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
New Mexico Metropolitan	A	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	B	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	C	0.00	0.00	0.00	0.06	0.00	0.00	0.02	0.00	0.00
Utah Metropolitan	A	0.00	0.00	0.05	0.00	0.00	0.00	0.00	0.00	0.00
	B	0.00	0.00	0.05	0.00	0.00	0.00	0.00	0.00	0.01
	C	0.00	0.05	0.09	0.11	0.00	0.00	0.01	0.01	0.00
Wyoming Metropolitan	A	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	B	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	C	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
High Plains	A	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	B	0.00	0.00	0.00	0.25	0.00	0.00	0.07	0.00	0.00
	C	0.25	0.08	0.17	0.32	0.24	0.17	0.27	0.22	0.21
Rocky Mountain	A	0.23	0.30	0.29	0.00	0.00	0.00	0.04	0.05	0.05
	B	0.00	0.00	0.20	0.12	0.00	0.00	0.04	0.00	0.03
	C	0.00	0.00	0.11	0.23	0.00	0.00	0.13	0.04	0.02
Great Basin	A	0.74	0.71	0.74	0.62	0.00	0.00	0.31	0.12	0.13
	B	0.62	0.59	0.56	0.62	0.18	0.00	0.29	0.15	0.09
	C	0.62	0.59	0.56	0.62	0.18	0.00	0.44	0.15	0.09

Source: Rose and Frias (1993).

TABLE 18 Estimated Impacts on Population, GRP, Disposable Income, and Employment[a]: Commitment-Level Alternative 1

Subregion[b]	Supply Option	Population 1993	Population 2000	Population 2008	Gross Regional Product 1993	Gross Regional Product 2000	Gross Regional Product 2008	Disposable Income 1993	Disposable Income 2000	Disposable Income 2008	Employment 1993	Employment 2000	Employment 2008
		Impacts (percent change from baseline) by Year										
1	A	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	B	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	C	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2	A	0.00	0.02	0.03	0.00	0.03	0.04	0.00	0.03	0.04	0.01	0.02	0.03
	B	0.00	-0.02	-0.02	-0.03	-0.03	-0.03	-0.03	-0.02	-0.02	-0.02	-0.03	-0.02
	C	-0.02	-0.12	-0.13	-0.09	-0.20	-0.20	-0.10	-0.15	-0.14	-0.08	-0.15	-0.13
3	A	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	B	0.00	0 00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	C	0.00	0.00	-0.01	0.00	-0.01	-0.01	0.00	-0.01	-0.01	0.00	-0.01	-0.01
4	A	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	B	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	C	0.00	-0.02	-0.02	-0.01	-0.02	-0.02	-0.02	-0.02	-0.02	-0.01	-0.01	-0.02
5	A	-0.01	-0.01	0.04	-0.01	-0.01	0.05	-0.02	0.00	0.08	-0.01	0.00	0.04
	B	-0.01	-0.03	0.02	-0.03	-0.02	0.03	-0.04	-0.03	0.06	-0.03	-0.02	0.04
	C	-0.02	-0.10	-0.01	-0.07	-0.09	0.01	-0.06	-0.12	0.04	-0.07	-0.07	0.03
6	A	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	B	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	C	0.00	0.00	-0.01	0.00	0.00	0.00	0.00	0.00	-0.01	0.00	0.00	0.00
7	A	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-0.01	-0.01	0.00	0.00	0.00
	B	0.00	-0.01	-0.01	-0.01	0.00	0.00	-0.01	-0.01	-0.01	-0.01	-0.01	0.00
	C	-0.01	-0.05	-0.07	-0.05	-0.04	-0.04	-0.08	-0.07	-0.07	-0.05	-0.04	-0.04
8	A	0.00	0.00	0.02	0.00	0.01	0.02	0.00	0.02	0.04	0.00	0.01	0.02
	B	0.00	-0.01	0.00	-0.02	-0.01	0.00	-0.03	0.00	0.01	-0.02	-0.01	0.01
	C	-0.02	-0.10	-0.08	-0.06	-0.08	-0.07	-0.14	-0.13	-0.10	-0.06	-0.07	-0.06
9	A	0.00	-0.04	0.05	0.01	0.02	0.05	0.01	0.04	0.09	0.01	0.01	0.05
	B	0.00	0.00	0.04	-0.01	0.00	0.04	-0.02	0.01	0.08	-0.01	0.00	0.03
	C	-0.02	-0.07	-0.02	-0.05	-0.05	-0.01	-0.12	-0.08	0.00	-0.05	-0.05	0.01

[a] The data were estimated by using the REMI modeling system.

[b] 1 = Arizona Metropolitan Subregion, 2 = Colorado Metropolitan Subregion, 3 = Nevada Metropolitan Subregion, 4 = New Mexico Metropolitan Subregion, 5 = Utah Metropolitan Subregion, 6 = Wyoming Metropolitan Subregion, 7 = High Plains Subregion, 8 = Rocky Mountains Subregion, and 9 = Great Basin Subregion.

on disposable income in these regions, with impacts of 0.08% in the Utah Metropolitan Subregion and 0.04% in the Colorado Metropolitan and Rocky Mountain Subregions. Impacts on the other variables in these regions would be smaller, ranging from Zero to 0.04%.

The impacts of supply option B would generally be smaller than those of supply option A. The largest impacts would occur in the Great Basin Subregion, with disposable income showing the largest deviations from the baseline, the largest change being 0.08% in 2008 (Table 18). Smaller positive impacts would occur on GRP (0.04%), population (0.04%), and employment (0.03%), also in 2008. Small negative changes in these variables would occur under supply option B in 2000. Impacts elsewhere in the service territory would be even smaller; in the Utah Metropolitan Subregion, impacts would be close to zero in 2000 with a maximum of 0.06% for disposable income. In the Colorado Metropolitan Subregion, impacts on each variable would be negative in both years, with a maximum of −0.03% in 2008.

Larger negative impacts would occur if supply option C were chosen, although primarily in the Colorado Metropolitan Subregion (Table 18), where GRP would change by −0.20% in both 2000 and 2008, disposable income would change by −0.14%, and employment would change by −0.13%. Smaller changes would occur in 2000 for these three variables. Impacts of supply option C would be smaller elsewhere in the service territory; impacts in the Rocky Mountain Subregion would peak at −0.13% for disposable income in 2000, with smaller impacts of −0.10% in 2008 for disposable income and in 2000 for population.

The impact of alternative 1 on households with annual incomes of less than $30,000 would be the largest in the High Plains Subregion in 2000 and 2008, where 0.35% and 0.28% of households, respectively, would experience a decrease in income of more than $500 per year under supply option C (Table 17). Smaller impacts under alternative 1 would occur in the Great Basin Subregion, where 0.21% and 0.25% of households, respectively, would experience a decrease in income of more than $500 per year in 2000 and 2008 under supply option C. More than 99.5% of households with annual incomes of less than $30,000 would experience decreases in income of less than $500 per year for any of the three scenarios under alternative 1.

5.2.3 Commitment-Level Alternative 2 — High Capacity, Low Energy

The impacts from alternative 2 would be spread more evenly across the service territory than would be the case with the no-action alternative or alternative 1 (Table 19). Impacts would also vary from positive for supply option A to negative for supply options B and C. Under supply option A, the would be largest in the Colorado Metropolitan Subregion, where impacts would be positive and reach 0.20% in 2008 for GRP. For population, disposable income, and employment, the impacts would be smaller in both years at 0.12-0.15%. Smaller impacts from supply option A would occur in the Utah Metropolitan Subregion, where the largest impacts would be changes in disposable income of −0.10% in 2000 and 0.11% in 2008. Smaller impacts would occur in 2008 in GRP (−0.08%), population

TABLE 19 Estimated Impacts on Population, GRP, Disposable Income, and Employment[a]: Commitment-Level Alternative 2

Subregion[b]	Supply Option	Population			GRP			Disposable Income			Employment		
		1993	2000	2008	1993	2000	2008	1993	2000	2008	1993	2000	2008
1	A	0.00	-0.01	0.00	-0.01	-0.01	0.00	-0.01	-0.01	0.00	-0.01	-0.01	0.00
	B	0.00	-0.01	-0.01	-0.01	-0.01	0.00	-0.01	-0.01	0.00	-0.01	-0.01	0.00
	C	0.00	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	0.00
2	A	0.02	0.12	0.13	0.08	0.19	0.20	0.09	0.15	0.14	0.07	0.14	0.13
	B	0.00	0.00	-0.01	0.00	-0.01	-0.02	0.00	0.00	-0.02	0.00	-0.01	-0.02
	C	-0.01	-0.05	-0.07	-0.04	-0.09	-0.10	-0.04	-0.07	-0.08	-0.03	-0.07	-0.07
3	A	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	B	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	C	0.00	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	0.00	-0.01	-0.01
4	A	0.00	0.00	0.00	0 00	0.00	0.00	0.00	0.00	-0.01	0.00	0.00	0.00
	B	0.00	0.00	-0.01	0.00	0.00	-0.01	0.00	0.00	-0.01	0.00	0.00	-0.01
	C	0.00	-0.01	-0.02	0.00	-0.01	-0.02	-0.01	-0.01	-0.02	-0.01	-0.01	-0.02
5	A	-0.01	-0.06	-0.07	-0.04	-0.07	-0.08	-0.07	-0.10	-0.11	-0.04	-0.06	-0.06
	B	-0.01	-0.09	-0.10	-0.06	-0.09	-0.10	-0.10	-0.13	-0.14	-0.06	-0.08	-0.07
	C	-0.02	-0.13	-0.13	-0.09	-0.13	-0.12	-0.15	-0.19	-0.17	-0.09	-0.11	-0.08
6	A	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	B	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	C	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7	A	0.00	0.02	0.01	0.01	0.01	0.01	0.02	0.02	0.01	0.01	0.01	0.00
	B	-0.00	0.00	-0.01	0.00	0.00	-0.01	0.00	0.00	-0.02	0.00	0.00	-0.01
	C	-0.01	-0.03	-0.04	-0.03	-0.02	-0.03	-0.04	-0.04	-0.05	-0.03	-0.02	-0.03
8	A	0.01	0.03	0.02	0.02	0.02	0.02	0.04	0.03	0.02	0.02	0.02	0.01
	B	0.00	0.00	-0.02	0.00	-0.01	-0.07	0.00	-0.02	-0.03	0.00	-0.01	-0.01
	C	-0.01	-0.04	-0.06	-0.03	-0.04	-0.05	-0.05	-0.08	-0.07	-0.03	-0.04	-0.04
9	A	0.00	0.00	-0.02	0.00	-0.01	-0.02	-0.01	-0.02	-0.05	0.00	-0.01	-0.02
	B	-0.01	-0.02	-0.04	-0.02	-0.03	-0.04	-0.05	-0.05	-0.07	-0.02	-0.02	-0.03
	C	-0.01	-0.06	-0.07	-0.04	-0.05	-0.07	-0.10	-0.10	-0.11	-0.04	-0.05	-0.05

[a] The data were estimated by using the REMI modeling system.

[b] 1 = Arizona Metropolitan Subregion, 2 = Colorado Metropolitan Subregion, 3 = Nevada Metropolitan Subregion, 4 = New Mexico Metropolitan Subregion, 5 = Utah Metropolitan Subregion, 6 = Wyoming Metropolitan Subregion, 7 = High Plains Subregion, 8 = Rocky Mountains Subregion, and 9 = Great Basin Subregion.

(–0.07%), and employment (–0.06%). Elsewhere in the service territory, impacts would be less than –0.05% for each of the four variables.

The Utah Metropolitan Subregion would experience the largest impacts under supply option B, with disposable income showing the largest deviations from the baseline (Table 19). These changes would be –0.13% in 2000 and –0.14% in 2008. Changes to population and GRP would also be largest in 2008, at –0.10%. Changes to these variables in 2000 and to employment in both years would be less than –0.10%. Smaller impacts under supply option B would occur in the Great Basin Subregion, where the majority of impacts would be less than –0.05% in both 2000 and 2008.

The impacts of supply option C would also be the largest in the Utah Metropolitan Subregion (Table 19). The largest impacts in the Utah Metropolitan Subregion would occur on disposable income, with changes of –0.19 and –0.20% in 2000 and 2008. Impacts on population and GRP would be –0.13% in 2000, and similar impacts would occur in 2008. Employment would change by –0.11% in 2000 and –0.08% in 2008. Smaller impacts would occur in the Colorado Metropolitan Subregion, where GRP would show the largest impacts, changing by –0.10% in 2008, and the Great Basin Subregion, where disposable income would be the most affected, changing by –0.11% in 2008. Impacts in other years and for other variables in these two regions would all be less than –0.10%.

The impact of alternative 2 on households with annual incomes of less than $30,000 would be the greatest in the High Plains Subregion, where 0.25% of households would experience a decrease in income of more than $500 per year from supply option C in 1993 (Table 17). Impacts would be smaller in this region in 2000 or 2008. Smaller impacts from alternative 2 would occur in the Great Basin Subregion under supply option C in 1993, where 0.19% of households would experience a decrease in income of more than $500 per year in 2000 and 2008. More than 99.5% of households with annual incomes of less than $30,000 would experience a decrease in income of less than $500 per year for any of the three scenarios under alternative 2.

5.2.4 Commitment-Level Alternative 3 — Moderate Capacity, Low Energy

As would be the case with alternative 2, the impacts of alternative 3 would vary across the service territory according to the preferred supply option (Table 20). For supply option A, the largest impacts would occur in the Colorado Metropolitan Subregion, with the largest impacts occurring on GRP at 0.10% in both 2000 and 2008. Smaller changes would occur in 2008 in population and disposable income (0.07%) and in employment (0.06%). Elsewhere in the service territory, smaller impacts would occur under supply option A in the Utah Metropolitan and Great Basin Subregions. Changes in each of the four variables would be negative in these subregions, with the maximum impacts occurring on disposable income in 2008. The maximum impact in these two subregions would be –0.10%, while the majority of changes would be less than –0.05%.

TABLE 20 Estimated Impacts on Population, GRP, Disposable Income, and Employment[a]: Commitment-Level Alternative 3

Subregion[b]	Supply Option	Population			GRP			Disposable Income			Employment		
		1993	2000	2008	1993	2000	2008	1993	2000	2008	1993	2000	2008
1	A	0.00	-0.01	0.00	-0.01	-0.01	0.00	-0.01	-0.01	0.00	-0.01	-0.01	0.00
	B	0.00	-0.01	-0.01	-0.01	-0.01	0.00	-0.01	-0.01	0.00	-0.01	-0.01	-0.01
	C	0.00	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	0.00
2	A	0.01	0.06	0.07	0.05	0.10	0.10	0.05	0.08	0.07	0.04	0.07	0.06
	B	0.00	-0.01	-0.02	0.00	-0.02	-0.03	0.00	-0.01	-0.03	0.00	-0.02	-0.03
	C	-0.01	-0.07	-0.09	-0.05	-0.12	-0.13	-0.05	-0.10	-0.10	-0.04	-0.09	-0.09
3	A	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	B	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	C	0.00	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	0.00	-0.01	-0.01
4	A	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-0.01	0.00	0.00	0.00
	B	0.00	0.00	-0.01	0.00	0.00	-0.01	0.00	0.00	0.00	0.00	0.00	-0.01
	C	0.00	-0.01	-0.02	0.00	-0.01	-0.02	-0.01	-0.01	-0.02	-0.01	-0.01	-0.02
5	A	-0.01	-0.03	-0.05	-0.02	-0.04	-0.07	-0.04	-0.06	-0.10	-0.02	-0.04	-0.05
	B	-0.01	-0.06	-0.07	-0.04	-0.06	-0.08	-0.06	-0.08	-0.11	-0.04	-0.05	-0.06
	C	-0.02	-0.11	-0.12	-0.07	-0.11	-0.12	-0.10	-0.16	-0.18	-0.07	-0.09	-0.09
6	A	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	B	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	C	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7	A	0.00	0.01	0.00	-0.01	-0.01	0.00	-0.01	-0.01	0.00	0.01	0.01	0.00
	B	0.00	-0.01	-0.01	0.00	0.00	-0.01	-0.01	-0.01	-0.02	0.00	0.00	-0.01
	C	-0.01	-0.04	-0.04	-0.04	-0.03	-0.03	-0.05	-0.05	-0.06	-0.04	-0.03	-0.03
8	A	0.01	-0.01	0.00	0.01	0.00	0.00	-0.02	0.01	-0.01	-0.01	0.00	0.00
	B	0.00	-0.01	-0.03	-0.01	-0.02	-0.02	-0.01	-0.03	-0.04	-0.01	-0.02	-0.02
	C	-0.01	-0.05	-0.07	-0.03	-0.05	-0.06	-0.06	-0.09	-0.08	-0.03	-0.05	-0.05
9	A	0.00	-0.02	-0.04	-0.01	-0.02	-0.04	-0.03	-0.04	-0.08	-0.01	-0.02	-0.04
	B	-0.01	-0.04	-0.06	-0.03	-0.04	-0.06	-0.06	-0.07	-0.09	-0.03	-0.03	-0.04
	C	-0.02	-0.08	-0.10	-0.05	-0.07	-0.09	-0.12	-0.12	-0.14	-0.05	-0.06	-0.07

[a] The data were estimated by using the REMI modeling system.

[b] 1 = Arizona Metropolitan Subregion, 2 = Colorado Metropolitan Subregion, 3 = Nevada Metropolitan Subregion, 4 = New Mexico Metropolitan Subregion, 5 = Utah Metropolitan Subregion, 6 = Wyoming Metropolitan Subregion, 7 = High Plains Subregion, 8 = Rocky Mountains Subregion, and 9 = Great Basin Subregion.

Under supply option B, the Utah Metropolitan Subregion would be most affected, with changes of -0.11% from the baseline in disposable income in 2008 (Table 20). Changes to population, GRP, and employment would be less than −0.10% in both 2000 and 2008. Smaller impacts from supply option B would occur in the Great Basin Subregion, where none of the changes from the baseline in any of the variables would exceed −0.10%, and in the Colorado Metropolitan Subregion, where none of the changes would exceed −0.05%. In both regions, impacts would be largest in disposable income.

Supply option C would produce larger impacts in the Colorado Metropolitan Subregion than elsewhere in the service territory, and there would be smaller impacts in the Utah Metropolitan and Great Basin subregions (Table 20). In the Colorado Metropolitan Subregion, the largest impacts would be on GRP, where changes would be −0.10% in both 2000 and 2008. Smaller impacts would occur on population and on disposable income, where the impact of supply option B would be −0.07% in 2008. In the Utah Metropolitan and Great Basin Subregions, the majority of changes would be less than −0.05%, with larger changes occurring in disposable income in 2008 in the Utah Metropolitan Subregion.

The largest impact of alternative 3 on households with annual incomes of less than $30,000 would occur in the Great Basin Subregion in 1993, where 0.32% of households would experience a decrease in income of more than $500 per year under supply option C (Table 17). No impacts would occur in this region in 2000 or 2008. Smaller impacts of alternative 3 would occur in the High Plains Subregion under supply option C, where 0.19% and 0.20% of households, respectively, would experience a decrease in income of more than $500 per year in 2000 and 2008. More than 99.5% of households with annual incomes of less than $30,000 would experience a decrease in income of less than $500 per year for any of the three scenarios under alternative 3.

5.2.5 Commitment-Level Alternative 4 — Lowest Capacity, Low Energy

The maximum impacts of alternative 4 would be the largest impacts of any of the alternatives (Table 21). Under supply option A, the largest impacts would occur in the Great Basin Subregion, where the largest impact would occur on disposable income, at −0.27% in 2008. Smaller changes would occur on population and GRP (−0.16%) and employment (−0.14%). In 2000, changes in each of these variables would be less than −0.10% from the baseline. Elsewhere in the service territory, smaller impacts would occur under supply option A in the Utah Metropolitan Subregion, where the largest impact would be on disposable income, at −0.21% in 2008. Smaller changes would occur in 2008 on GRP (−0.13%), employment (−0.11%), and population (−0.10%). In 2000, changes in each of these variables would be at or less than −0.05%.

Under supply option B, the Great Basin Subregion would again be the most affected, with changes of −0.29% from the baseline in disposable income in 2008 (Table 21). Changes to population, GRP, and employment in 2008 would range from −0.14% for employment to −0.18% for GRP. Smaller impacts under supply option B would occur in the Utah

TABLE 21 Estimated Impacts on Population, GRP, Disposable Income, and Employment[a]; Commitment-Level Alternative 4

Impacts (percent change from baseline) by Year

Subregion[b]	Supply Option	Population 1993	Population 2000	Population 2008	GRP 1993	GRP 2000	GRP 2008	Disposable Income 1993	Disposable Income 2000	Disposable Income 2008	Employment 1993	Employment 2000	Employment 2008
1	A	0.00	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
	B	0.00	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
	C	0.00	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01
2	A	0.01	0.00	-0.01	0.03	0.00	-0.02	0.03	0.00	-0.03	0.02	0.00	-0.02
	B	0.00	-0.02	-0.03	0.02	-0.04	-0.06	0.02	-0.03	-0.05	0.02	-0.03	-0.05
	C	0.00	-0.05	-0.07	-0.01	-0.09	-0.12	-0.01	-0.07	-0.09	-0.01	-0.07	-0.08
3	A	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	B	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	C	0.00	0.00	0.00	-0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4	A	0.00	0.00	-0.01	0.00	0.00	-0.01	0.00	-0.01	-0.01	0.00	0.00	-0.01
	B	0.00	0.00	-0.01	0.00	-0.01	-0.01	0.00	-0.01	-0.01	0.00	-0.01	-0.01
	C	0.00	-0.01	-0.02	0.00	-0.01	-0.02	0.00	-0.01	-0.02	0.00	-0.01	-0.01
5	A	0.00	-0.03	-0.10	-0.01	-0.03	-0.13	-0.02	-0.05	-0.21	-0.01	-0.03	-0.11
	B	0.00	-0.04	-0.11	-0.02	-0.04	-0.14	-0.03	-0.06	-0.22	-0.02	-0.03	-0.12
	C	-0.01	-0.09	-0.21	-0.05	-0.10	-0.23	-0.08	-0.14	-0.36	-0.05	-0.08	-0.19
6	A	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	B	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	C	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
7	A	0.00	0.00	-0.01	0.00	0.00	-0.01	0.00	-0.01	-0.02	0.00	0.00	-0.01
	B	0.00	-0.01	-0.02	-0.01	-0.01	-0.02	-0.02	-0.02	-0.03	-0.01	-0.01	-0.02
	C	-0.01	-0.03	-0.03	-0.03	-0.02	-0.03	-0.04	-0.04	-0.05	-0.01	-0.02	-0.03
8	A	0.00	-0.02	-0.05	-0.01	-0.03	-0.06	-0.01	-0.05	-0.09	-0.01	-0.03	-0.05
	B	0.00	-0.04	-0.07	-0.01	-0.04	-0.07	-0.02	-0.07	-0.10	-0.01	-0.04	-0.06
	C	-0.01	-0.04	-0.06	-0.02	-0.04	-0.06	-0.03	-0.06	-0.08	-0.02	-0.04	-0.05
9	A	-0.02	-0.10	-0.16	-0.06	-0.09	-0.16	-0.14	-0.16	-0.27	-0.06	-0.08	-0.14
	B	-0.02	-0.11	-0.17	-0.06	-0.10	-0.18	-0.15	-0.18	-0.29	-0.07	-0.09	-0.14
	C	-0.03	-0.14	-0.20	-0.08	-0.13	-0.20	-0.19	-0.22	-0.32	-0.08	-0.11	-0.16

[a] The data were estimated by using the REMI modeling system.

[b] 1 = Arizona Metropolitan Subregion, 2 = Colorado Metropolitan Subregion, 3 = Nevada Metropolitan Subregion, 4 = New Mexico Metropolitan Subregion, 5 = Utah Metropolitan Subregion, 6 = Wyoming Metropolitan Subregion, 7 = High Plains Subregion, 8 = Rocky Mountains Subregion, and 9 = Great Basin Subregion.

Metropolitan Subregion, where the largest change from the baseline would be −0.22% for disposable income. Other changes would be −0.14% for GRP, −0.11% for population, and −0.12% for employment. Smaller impacts would occur elsewhere in the affected region, with no changes in excess of −0.10% for any of the variables in either 2000 or 2008.

Supply option C would produce larger impacts in the Utah Metropolitan Subregion than elsewhere in the service territory, and there would be slightly smaller impacts in the Great Basin Subregion (Table 21). In the Utah Metropolitan Subregion, the largest impacts under this supply option would be on GRP, where the change would be −0.36% in 2008, a change from −0.14% in 2000. Smaller impacts would occur on GRP, which would change by −0.23% in 2008, and on population and disposable income, where the impacts of supply option B in 2008 would be −0.21% and −0.19%, respectively. Despite the comparatively large changes in these subregions, most changes elsewhere in the service territory would be less than −0.15%, with the largest change (−0.12%) occurring in GRP in 2008 in the Utah Metropolitan Subregion.

The impact of alternative 4 on households with annual incomes of less than $30,000 would be the largest in the Great Basin Subregion, where 0.74% of households would experience a decrease in income of more than $500 per year under supply option A in 1993 and 2008, with 0.71% of households experiencing the same impact in 2000 (Table 17). Impacts under this alternative would be slightly smaller for supply options B and C in the Great Basin Subregion, where 0.62-0.56% of households would experience a decrease in income of up to $500 per year in 1993 and 2008. Under alternative 4, smaller impacts would occur in the High Plains and Rocky Mountain Subregions under supply option C, where 0.30% of households would experience an increase in income of more than $500 per year in 2000 and 2008. More than 99.25% of households with annual incomes of less than $30,000 would experience a decrease in income of less than $500 per year for any of the three scenarios under alternative 4.

5.2.6 Commitment-Level Alternative 5 — Baseload

The majority of impacts under supply options A and B combined with alternative 5 would be small compared with those under the other alternatives considered in the regional analysis, with larger impacts occurring under supply option C in the Great Basin Subregion at the beginning of the forecast period (Table 22). Under supply option A, the largest impacts would occur in the Great Basin Subregion, where the impacts tend to be largest in the year 2000. The largest impact would be on disposable income, at −0.10%, with smaller changes in GRP (−0.07%), population (−0.05%), and employment (−0.03%) in 2000. In 2000, impacts would be slightly smaller, with a maximum of −0.07% on under disposable income. Elsewhere in the service territory, smaller impacts would occur under supply option A in the Colorado Metropolitan Subregion. Changes in each of the four variables would be at or less than −0.05%, and the largest impact would be on GRP in 2008.

Under supply option B, the Great Basin Subregion would again be the most affected, with changes larger in 2000 than 2008. Changes of −0.14% from the baseline would occur

TABLE 22 Estimated Impacts on Population, GRP, Disposable Income, and Employment[a]: Commitment-Level Alternative 5

| | | Impacts (percent change from baseline) by Year | | | | | | | | | | | |
| | | Population | | | GRP | | | Disposable Income | | | Employment | | |
Subregion[b]	Supply Option	1993	2000	2008	1993	2000	2008	1993	2000	2008	1993	2000	2008
1	A	0.00	-0.01	0.00	-0.01	-0.01	0.00	-0.01	-0.01	0.00	0.00	-0.01	0.00
	B	0.00	-0.01	-0.01	-0.01	-0.01	0.00	-0.01	-0.01	0.00	-0.01	-0.01	0.00
	C	0.00	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	0.00
2	A	0.00	-0.03	-0.02	-0.01	-0.04	-0.05	-0.01	-0.02	-0.03	0.00	-0.03	-0.03
	B	-0.01	-0.05	-0.05	-0.03	-0.08	-0.09	-0.03	-0.05	-0.06	-0.02	-0.06	-0.05
	C	-0.01	-0.10	-0.10	-0.05	-0.15	-0.16	-0.06	-0.11	-0.10	-0.05	-0.11	-0.10
3	A	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	B	0 00	0.00	0.00	0.00	0.00	0.0	0.00	0.00	0.00	0.00	0.00	0.00
	C	0.00	0.00	-0.01	0.00	-0.01	-0.01	0.00	-0.01	-0.01	0.00	-0.01	-0.01
4	A	0.00	0.00	-0.01	0.00	0.00	-0.01	0.00	-0.01	-0.01	0.00	0.00	-0.01
	B	0.00	-0.01	-0.02	0.00	-0.01	-0.02	-0.01	-0.02	-0.02	0.00	-0.01	-0.01
	C	0.00	-0.02	-0.02	-0.01	-0.02	-0.03	-0.01	-0.02	-0.03	-0.01	-0.02	-0.02
5	A	-0.01	-0.03	0.03	-0.03	-0.01	0.02	-0.04	-0.01	0.04	-0.02	-0.01	0.02
	B	-0.01	-0.05	0.01	-0.05	-0.04	0.01	-0.07	-0.05	0.02	-0.04	-0.03	0.01
	C	-0.02	-0.10	-0.05	-0.07	-0.09	-0.05	-0.12	-0.11	-0.05	-0.07	-0.07	-0.02
6	A	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	B	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	C	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-0.01	0.00	0.00	0.00
7	A	0.00	-0.01	-0.01	-0.01	-0.01	-0.01	-0.02	-0.01	-0.01	-0.01	-0.01	-0.01
	B	-0.01	-0.03	-0.02	-0.03	-0.02	-0.02	-0.04	-0.03	-0.03	-0.04	-0.02	-0.02
	C	-0.01	-0.05	-0.05	-0.05	-0.04	-0.04	-0.07	-0.06	-0.06	-0.05	-0.04	-0.03
8	A	-0.01	-0.05	-0.03	-0.02	-0.03	-0.03	-0.04	-0.04	-0.03	-0.02	-0.03	-0.01
	B	-0.01	-0.07	-0.05	-0.04	-0.05	-0.05	-0.08	-0.06	-0.05	-0.04	-0.04	-0.03
	C	-0.02	-0.11	-0.08	-0.06	-0.08	-0.08	-0.12	-0.10	-0.08	-0.06	-0.07	-0.05
9	A	-0.02	-0.09	-0.05	-0.06	-0.07	-0.06	-0.15	-0.10	-0.07	-0.06	-0.06	-0.03
	B	-0.03	-0.12	-0.07	-0.08	-0.09	-0.07	-0.19	-0.14	-0.09	-0.08	-0.07	-0.04
	C	-0.03	-0.15	-0.10	-0.10	-0.12	-0.10	-0.24	-0.18	-0.12	-0.10	-0.10	-0.06

[a] The data were estimated by using the REMI modeling system.

[b] 1 = Arizona Metropolitan Subregion, 2 = Colorado Metropolitan Subregion, 3 = Nevada Metropolitan Subregion, 4 = New Mexico Metropolitan Subregion, 5 = Utah Metropolitan Subregion, 6 = Wyoming Metropolitan Subregion, 7 = High Plains Subregion, 8 = Rocky Mountains Subregion, and 9 = Great Basin Subregion.

in disposable income in 2000 (Table 22), and changes to population, GRP, and employment in this subregion in 2008 would range from –0.10 to –0.15%. Smaller impacts would occur in 2008; the largest impacts would be –0.12%, again on disposable income, followed by smaller impacts on population and GRP (–0.10%) and employment (–0.04%). Smaller impacts under supply option B would occur in the Colorado Metropolitan Subregion, but none of the changes from the baseline in any of the variables considered would exceed –0.10%; the largest impacts would occur in GRP.

Supply option C would produce larger impacts in the Great Basin and Colorado Metropolitan Subregions than elsewhere in the service territory, and there would be smaller impacts in the Utah Metropolitan and Rocky Mountain Subregions (Table 22). In the Great Basin Subregion, the largest impacts would be on disposable income at the beginning of the forecast period, followed by changes of –0.18% in 2000 and –0.12% in 2008. Smaller impacts would occur on population (–0.15%), GRP (–0.12%), and employment (–0.10%). Smaller impacts would occur in 2008 in the Great Basin Subregion, where no impacts would be larger than –0.12%. In the Colorado Metropolitan Subregion, impacts would be larger at the end of the forecast period, although none would be larger than the –0.16% change occurring in GRP in 2008. Impacts in the Utah Metropolitan and Rocky Mountain Subregions under supply option C would be largest on disposable income, with maximum impacts of –0.11% in 2000. Impacts on disposable income would be smaller in 2008, when the largest impact would be –0.08%; for the other variables, the largest impact would be –0.09%.

The largest impact under alternative 5 on households with annual incomes of less than $30,000 would occur in the Great Basin Subregion in 1993, where 0.62% of households would experience a decrease in income of more than $500 per year under each supply option (Table 17). Under alternative 5, smaller impacts would occur in the High Plains Subregion under supply options B and C: 0.25% of households would experience a decrease in income of more than $500 per year in 1993 under supply option B, and 0.32-0.17% of households would be affected by supply option C. More than 99.5% of households with annual incomes of less than $30,000 would therefore experience a decrease in income of less than $500 per year under any of the three scenarios under alternative 5.

5.2.7 Commitment-Level Alternative 6 — Moderate Capacity, Moderate Energy

The impacts of alternative 6 would be concentrated in the Great Basin and Utah Metropolitan Subregions, and larger impacts would occur at the end of the forecast period (Table 23). Under supply option A, the largest impacts would occur on disposable income in the Great Basin Subregion, where the largest impact would be –0.08% in 2008, and there would be smaller changes in GRP and population (–0.05%) and employment (–0.04%). In the Utah Metropolitan Subregion, supply option A would change disposable income by –0.05%, and there would be smaller changes in GRP (–0.03%) and in population and employment (–0.02%). The majority of changes elsewhere in the service territory for each of the four variables would be –0.03% or less.

TABLE 23 Estimated Impacts on Population, GRP, Disposable Income, and Employment[a]: Commitment-Level Alternative 6

| | | Impacts (percent change from baseline) by Year | | | | | | | | | | | |
| | | Population | | | GRP | | | Disposable Income | | | Employment | | |
Subregion[b]	Supply Option	1993	2000	2008	1993	2000	2008	1993	2000	2008	1993	2000	2008
1	A	0.00	-0.01	0.00	-0.01	-0.01	0.00	-0.01	-0.01	0.00	0.00	-0.01	0.00
	B	0.00	-0.01	-0.01	-0.01	-0.01	0.00	-0.01	-0.01	0.00	-0.01	-0.01	-0.01
	C	0.00	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	0.00
2	A	0.01	0.02	0.07	0.02	0.03	0.02	0.02	0.02	0.01	0.02	0.02	0.01
	B	0.00	-0.02	-0.03	-0.01	-0.04	-0.05	-0.01	-0.03	-0.04	-0.01	-0.03	-0.04
	C	-0.02	-0.09	-0.10	-0.05	-0.14	-0.15	-0.06	-0.11	-0.11	-0.05	-0.11	-0.10
3	A	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	B	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	C	0.00	0.00	-0.01	0.00	-0.01	-0.01	0.00	-0.01	-0.01	0.00	-0.01	-0.01
4	A	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-0.01	0.00	0.00	0.00
	B	0.00	0.00	-0.01	0.00	0.00	-0.01	0.00	-0.01	0.00	0.00	0.00	-0.01
	C	0.00	-0.02	-0.02	-0.01	-0.02	-0.02	-0.01	-0.02	-0.02	-0.01	-0.01	-0.02
5	A	0.00	-0.03	-0.02	-0.02	-0.02	-0.03	-0.03	-0.03	-0.05	-0.02	-0.02	-0.02
	B	0.00	-0.04	-0.04	-0.03	-0.04	-0.04	-0.05	-0.05	-0.06	-0.03	-0.03	-0.03
	C	-0.02	-0.10	-0.10	-0.07	-0.10	-0.10	-0.09	-0.13	-0.13	-0.07	-0.08	-0.06
6	A	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	.0.00	0.00	0.00
	B	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	C	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-0.01	0.00	0.00	0.00
7	A	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	B	0.00	-0.01	-0.01	-0.01	-0.01	-0.01	-0.02	-0.02	-0.02	-0.01	-0.01	-0.01
	C	-0.01	-0.04	-0.05	-0.04	-0.03	-0.04	-0.06	-0.06	-0.06	-0.04	-0.03	-0.03
8	A	0.00	-0.01	-0.01	0.00	-0.01	-0.02	-0.01	-0.01	-0.02	0.00	-0.01	-0.01
	B	0.00	-0.03	-0.03	-0.02	-0.03	-0.03	-0.03	-0.04	-0.04	-0.02	-0.02	-0.02
	C	-0.02	-0.07	-0.07	-0.04	-0.06	-0.07	-0.09	-0.10	-0.08	-0.04	-0.06	-0.05
9	A	-0.01	0.02	-0.05	-0.03	-0.04	-0.05	-0.07	-0.06	-0.08	-0.03	-0.03	-0.04
	B	0.00	-0.06	-0.06	-0.04	-0.05	-0.06	-0.10	-0.09	-0.09	-0.04	-0.04	-0.04
	C	-0.02	-0.11	-0.10	-0.07	-0.09	-0.10	-0.16	-0.15	-0.14	-0.07	-0.08	-0.07

[a] The data were estimated by using the REMI modeling system.

[b] 1 = Arizona Metropolitan Subregion, 2 = Colorado Metropolitan Subregion, 3 = Nevada Metropolitan Subregion, 4 = New Mexico Metropolitan Subregion, 5 = Utah Metropolitan Subregion, 6 = Wyoming Metropolitan Subregion, 7 = High Plains Subregion, 8 = Rocky Mountains Subregion, and 9 = Great Basin Subregion.

Under supply option B, the Great Basin Subregion would again be the most affected, with the largest change of -0.09% from the baseline occurring in disposable income (Table 23). Smaller changes would occur in population and GRP (–0.06%) and employment (–0.04%). Smaller impacts under supply option B would occur in the Utah and Colorado Metropolitan Subregions, where changes from the baseline for all the variables would vary between –0.03% and –0.06%, and the largest impacts would be in disposable income.

Impacts under supply option C would be larger in the Great Basin and Utah Metropolitan Subregions than elsewhere in the service territory, and there would be smaller impacts in the Colorado Metropolitan Subregion (Table 23). In the Great Basin Subregion, the largest impacts would again be on disposable income at the beginning of the forecast period, followed by changes of –0.15% in 2000 and –0.14% in 2008. Smaller impacts would occur on population and GRP (–0.10%) and employment (–0.07%). Smaller impacts would occur in 2008 in the Great Basin Subregion; no impact would be larger than –0.14%. In the Utah Metropolitan Subregion, most of the impacts would be the same in both 2000 and 2008, although none of these impacts would be larger than –0.13%, and the largest changes would occur in disposable income. Impacts in the Colorado Metropolitan Subregion under supply option C would be largest on GRP, with a maximum impact of –0.15% in 2008. The impact on disposable income would be –0.11%, and the impact of supply option C on population and employment would be –0.10%.

The impact of alternative 6 on households with annual incomes of less than $30,000 would be the largest in the Great Basin Subregion, where 0.44% of households would experience a decrease in income of more than $500 per year under supply option C in 1993. Smaller impacts would result from supply options A and B, and for each supply option in 2000 or 2008 (Table 17). Under alternative 6, smaller impacts would occur in the High Plains Subregion under supply option C, where 0.27% of households would experience a decrease in income of more than $500 per year in 1993, with smaller impacts in 2000 and 2008. More than 99.5% of households with annual incomes of less than $30,000 would experience a decrease in income of less than $500 per year under any of the three scenarios under alternative 6.

5.3 Impacts in High-Reliance Counties

The analysis of the impacts of changes in electricity rates in the two high-reliance counties in New Mexico compares the impacts of changes in electricity expenditures resulting from each commitment-level alternative and supply option. The analysis of the impacts of changes in rates in the nine subregions that uses REMI compared the impacts of changes in commercial and industrial electricity prices and changes in residential expenditures on electricity resulting from each commitment-level alternative and supply option. Consequently, the results of the analyses, which were at the two geographic scales and used the two modeling frameworks, are not directly comparable. However, the relative importance of impacts of each commitment-level alternative and supply option for the two counties and for each subregion can still be compared by examining the percentage change in each variable from the baseline for each of the scenarios at each geographic scale.

Table 24 shows the maximum impacts of each commitment-level alternative and supply option combination on output, income, and employment. Impacts shown are percentage changes from the local baseline for the three years 1993, 2000, and 2008. The table shows that deviations in output, personal income, and employment from the baseline in the three years examined would be less than 2% for each of the alternatives and supply options and would be less than 1% in most cases.

TABLE 24 Impacts of Commitment-Level Alternatives and Supply Options on Output, Personal Income, and Employment in High-Reliance Counties[a]

Alternative/ Supply Option	Impact (percentage change from baseline) by County					
	County A			County B		
	Output	Personal Income	Employ-ment	Output	Personal Income	Employ-ment
NA/B	−0.02	−0.02	−0.01	−0.07	−0.11	−0.07
NA/C	−0.10	−0.11	−0.06	−0.53	−0.90	−0.53
1A	−0.02	−0.02	−0.01	+0.16	+0.27	+0.16
1B	−0.05	−0.06	−0.03	+0.07	+0.12	+0.07
1C	−0.12	−0.13	−0.08	−0.42	−0.72	−0.42
2A	−0.02	−0.02	−0.01	+0.16	+0.27	+0.16
2B	−0.05	−0.05	−0.03	−0.10	−0.17	−0.10
2C	−0.06	−0.07	−0.04	−0.26	−0.44	−0.25
3A	−0.04	−0.04	−0.02	−0.15	−0.25	−0.15
3B	−0.06	−0.07	−0.04	−0.24	−0.41	−0.24
3C	−0.10	−0.11	−0.07	−0.45	−0.77	−0.45
4A	−0.12	−0.13	−0.08	−0.82	−1.39	−0.81
4B	−0.13	−0.15	−0.09	−0.85	−1.45	−0.85
4C	−0.19	−0.21	−0.12	−0.97	−1.65	−0.97
5A	−0.20	−0.22	−0.13	−0.70	−1.20	−0.70
5B	−0.26	−0.28	−0.17	−0.85	−1.44	−0.84
5C	−0.32	−0.35	−0.21	−1.04	−1.77	−1.03
6A	−0.08	−0.09	−0.05	−0.33	−0.56	−0.33
6B	−0.12	−0.13	−0.08	−0.41	−0.70	−0.41
6C	−0.17	−0.19	−0.11	−0.69	−1.17	−0.69

[a] The data were estimated with the IMPLAN modeling system and were rounded to two significant digits.

6 CONCLUSION

Changes in Western's power marketing programs that lead to a change in rates charged to utility consumers are likely to have only a minimal effect on the level of economic activity and growth potential in the area in which Western power is sold. The impacts of increases in electricity rates on disposable income, gross regional product (GRP), and employment do not exceed 0.40% for any of the commitment-level alternatives or supply options in any of the subregions for any of the years in the forecast period (1993-2008). None of these changes is statistically different from zero. Even though the rate increases arising from the commitment-level alternatives and supply options lead to slight changes in the cost of doing business in each of the subregions and could lead to the outward migration of businesses, these effects are of little importance. The consequent changes in the geographic distribution of economic opportunities would limit population growth and inward migration as well, but again, these changes are of no significance.

There are differences in the impact of changes in electricity rates across the nine subregions. Impacts are largest in the Rocky Mountain and Colorado Metropolitan Subregions for the majority of the variables in each alternative. The largest impacts generally occur toward the end of the power contract period in 2000 and 2008. The largest absolute impact is a decrease of 0.36% in disposable income under alternative 4C. Smaller decreases in each variable occur with the remaining alternatives, with positive impacts occurring under alternatives 1A, 1B, and 2A. Within each alternative, impacts are larger as one moves from the full flexibility supply option through low fluctuating flows to steady flows. Both the Nevada Metropolitan and the Wyoming Metropolitan Subregions fail to show any measurable impacts under any of the alternatives or supply options for the four variables considered. For the two high-reliance counties, deviations in output, personal income, and employment from the baseline in the three years examined would be less than 2% for each of the alternatives and supply options and would be less than 1% in most cases.

Changes in retail power rates do not have significant economic impacts in any of the subregions for three reasons. First, the proportion of total sales of electricity in any of the subregions by utilities buying power from Western is relatively small compared with sales by public utilities. Second, the level of reliance of Western customers on Western power is also relatively low. Therefore, even though there are large changes in the rates charged by some of Western's customer utilities, the impact on the cost of electricity in each subregion is small. Finally, electricity is not a significant input cost for the majority of sectors in each of the regions. Changes in electricity rates therefore do not significantly affect the cost of doing business in each of the subregions. In addition, the cost of electricity is not a significant element of household spending for most households in each region; thus, changes in electricity rates do not significantly affect the overall level of household spending or spending by lower-income households.

The significance of these factors for the relative magnitude of impacts can be seen through the impact of each alternative on GRP in the subregions where absolute impacts were largest. In the Colorado Metropolitan Subregion, economic impacts are related both to the proportion of power sales made by Western and to the amount of power sold by Western customer utilities to industrial customers. In this subregion, the no-action alternative and alternative 5, which have the largest regional and average customer reliance on Western, result in the largest changes in GRP. This result contrasts with the situation in the Utah and Great Basin Subregions, where the largest impact on GRP occurs under alternatives 2, 4, and 5, in which the proportion of power coming from Western tends to be lower. Utilities in these two subregions sell primarily to municipal systems and cooperatives that resell to residential customers and agricultural customers that receive industrial rates for power. In the Arizona, Nevada, New Mexico, and Wyoming Metropolitan Subregions, the impacts of each alternative are smaller because there is low regional reliance on Western power.

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APPENDIX A:

COUNTIES INCLUDED IN THE NINE SUBREGIONS

TABLE A.1 States and Counties Included in the Nine Subregions

Subregion	States	Counties
Metropolitan Subregions		
Arizona	Arizona	Maricopa, Pinal, Pima
Colorado	Colorado	Adams, Arapahoe, Boulder, Douglas, Jefferson, El Paso, Larimer, Weld, Pueblo
Nevada	Nevada	Clark
New Mexico	New Mexico	Bernalillo, Los Alamos, Santa Fe
Utah	Utah	Davis, Salt Lake, Weber, Utah
Wyoming	Wyoming	Natrona
Rural Subregions		
High Plains	Colorado	Baca, Bent, Cheyenne, Crowley, Elbert, Kiowa, Kit Carson, Las Animas, Lincoln, Logan, Morgan, Otero, Phillips, Prowers, Sedgwick, Washington, Yuma
	Montana	Big Horn
	Nebraska	Arthur, Banner, Box Butte, Chase, Cherry, Cheyenne, Dawes, Deuel, Dundy, Garden, Grant, Hayes, Hooker, Keith, Kimball, Lincoln, McPherson, Morrill, Perkins, Scotts Bluff, Sheridan, Sioux
	New Mexico	Chaves, Colfax, Curry, De Baca, Eddy, Guadalupe, Harding, Lea, Mora, Quay, Roosevelt, San Miguel, Union
	Oklahoma	Cimarron
	Texas	Cochran, Gaines, Hartley, Yoakum
	South Dakota	Fall River
	Wyoming	Albany, Campbell, Converse, Goshen, Johnson, Laramie, Niobrara, Platte, Sheridan, Weston

TABLE A.1 (Cont.)

Subregion	States	Counties
Rural Subregions (Cont.)		
Rocky Mountains	Arizona	Cochise, Graham, Greenlee
	Colorado	Alamosa, Archuleta, Chaffee, Clear Creek, Conejos, Costilla, Custer, Eagle, Fremont, Gilpin, Grand, Gunnison, Hinsdale, Huerfano, Jackson, La Plata, Lake, Mineral, Ouray, Park, Pitkin, Rio Grande, Routt, Saguache, San Juan, Summit, Teller
	Montana	Carbon
	New Mexico	Catron, Cibola, Grant, Hidalgo, Lincoln, Luna, McKinley, Otero, Rio Arriba, Sandoval, Sierra, Socorro, Taos, Torrance, Valencia
	Utah	Daggett, Morgan, Summit, Wasatch
	Wyoming	Big Horn, Carbon, Fremont, Hot Springs, Lincoln, Park, Sweetwater, Uinta, Washakie
Great Basin	Arizona	Apache, Coconino, Gila, La Paz, Mohave, Navajo, Santa Cruz, Yavapai, Yuma
	California	Inyo, Mono
	Colorado	Delta, Dolores, Garfield, Mesa, Moffat, Montezuma, Montrose, Rio Blanco, San Miguel
	Nevada	Elko, Esmeralda, Eureka, Lincoln, Mineral, Nye, White Pine
	New Mexico	San Juan
	Utah	Beaver, Box Elder, Cache, Carbon, Duchesne, Garfield, Iron, Juab, Kane, Millard, Piute, San Juan, Sanpete, Sevier, Tooele, Uintah, Washington, Wayne

APPENDIX B:

DESCRIPTION OF REGIONALIZATION TRANSLATION WORKSHEETS

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DESCRIPTION OF REGIONALIZATION TRANSLATION WORKSHEETS

The worksheet that translates the utility-level information into regional information is constructed in layers, with macros to handle data input and output. In descending order, the layers are output, base-case values, formulas, translation matrices, translation variables, cooked data, and input data. Each layer is briefly discussed.

The top layer is the information that is required by the REMI model, the agricultural model, and the income distribution analysis. The information on this level is in the formats required by the respective analyses. On this level, a macro writes out the files needed for the rest of the regional analysis and the agricultural analysis.

The next layer holds the base-case values of the variables. The layer below that contains the formulas that calculate the regional values for each year for the alternative under consideration. The top layers have the values as deviations from the base case; thus, the base-case values and the values for the alternative under consideration are contained in different levels of the worksheet. The layout of the base-case level and the formula level are identical for ease in copying and comparison.

Below the formula values are the translation matrixes that contain the factors needed for the translation. There are five matrices for the five types of data being translated: total revenue, residential, commercial, industrial, and agriculture. The rows of each matrix are the subregions, and the columns are all the utilities that sell in the affected area. Thus, the dot product of each vector of utility prices for a given year and the row of the matrix yields the regional price for that year. The results are then repeated for each year and placed in an element of the appropriate results matrix. The elements of the translation matrices differ by matrix, because the total revenue matrix contains the fraction of the utility's total revenue obtained in that region. The agricultural matrix contains the fraction of the utility's agricultural sales made in that subregion. For the other matrices, the elements are the number of customers of a particular class that the utility serves in that subregion. Such an allocation methodology accounts for utilities that sell in more than one subregion. The translation matrices are compiled and copied from the REG_TRAN.WK3 file. For such a methodology to work, the input variables must be of the correct units so that the units resulting from the multiplication are those desired. Since the data from the finance subtask are at the absolute levels, some translation variables are necessary.

The next layer contains the variables needed to translate the raw data into data that can be used by the formulas to calculate the appropriate variable in the appropriate units. These variables include the number of customers in each customer classification, the share of both revenue and sales for each customer classification, the utility code, and identification of the wholesale supplier. These variables are input from the REG_TRAN.WK3 file from the appropriate location specified in the file.

The layer below the translation variables contains the cooked data that are used in the vector multiplication discussed earlier. These data are total revenues, residential revenues, commercial revenues and sales, industrial revenues and sales, and agricultural revenues and sales. The total and agricultural revenues are in units of thousands of dollars. The other revenues, (i.e., residential, commercial, and industrial) are in units of thousands of dollars per customer. The commercial and industrial sales are in units of megawatt-hours per customer. These data are either input directly from different sources or calculated from data taken from the financial analysis, depending on the type of utility.

Finally, the bottom layer contains the raw data as provided by the finance subtask for a subset of the utility types.

There are five different types of utilities in the affected region:

- Non-Western customers, which are mostly investor-owned utilities and other municipalities.

- End-user customers who purchase power directly from Western and consume it directly, including government installations such as military bases as well as irrigation districts. There are no financial data on these customers.

- End-user customers that also resell the power they receive from Western. These customers have financial data but have not been modeled by the financial subtask.

- Small systems that have a direct Western allocation of power. These have been modeled by the financial subtask.

- Customers of wholesale utilities that receive Western power indirectly from their wholesale supplier. The financial analysis has modeled these utilities at the wholesale level and provided data at the wholesale level. Disaggregation is necessary to obtain data at the retail level.

The data requirements for each of these types differs.

Since Western's marketing programs do not directly affect the non-Western customers, the numbers for these utilities remain constant over all supply scenarios. Because there is no variation in this group of utilities, they were consolidated into nine different utilities, one for each of the regions. This consolidation was calculated in separate worksheets, NONWEST.WK3 and NONWSTTR.WK3. The data were aggregated up to the regional level and then imported into the worksheet. The translation matrices then contain only a zero or a one for the utilities in these appropriate regions.

The financial subtask provided a separate worksheet of information for the Western customers it did not model. This worksheet contained information on the way expenditures on electricity would change for each customer under each of the different marketing

alternatives. As mentioned earlier, this group was then divided into two parts, depending on whether the customer resold the power. Two separate worksheets emerged for the direct customers and resellers of the power, END_USE.WK3 and END_USER.WK3, respectively. These worksheets translated the information provided in the worksheet into a form that could then be read into the translation worksheet.

In the case of end-user customers, changes in expenditures and the quantity of power required from Western were calculated for each supply alternative. Formulas were constructed to put this information into the form required for the translation worksheet. In particular, the expenditures had to be copied from XXXX to YYYY, and the quantity to be purchased had to be copied from ZZZZZ to VVVVV. Then the output range could be copied into the translation worksheet; that is, the PPPPP range in END_USER.WK3 was copied into the QQQQQ range of the translation worksheet.

In the case of the end-user customers who also resell power, information on their sales to each customer class was used to construct appropriate data by using the inflation rates and projected load growth rates calculated in the demand subtask. The difference in the alternatives was construed as a one-time change in the utility's supply costs due to a change in Western marketing. This one-time price change was then incorporated into sales by customer class through appropriate formulas. These data were then put in the form needed by the translation worksheet. The appropriate price increase from the alternative (in the XXXXX range of the worksheet) was copied to YYYYYY, so that the formulas could calculate the data needed as input to the translation worksheet. Then the input data (CCCCCC in END_USE.WK3) were copied into the QQQQ range of the translation worksheet.

The data on the utilities analyzed by the financial subtask were read directly into the translation worksheet through an input data macro. These were coordinated with the financial subtask so that the data were in the same form. A worksheet was constructed for each utility that contained all relevant supply predictions for that utility under each supply alternative. Different range names were given to the results of a particular alternative. For example, the utility's price and quantity results for alternative 1-C were found in the range R_ALTX1C. A macro was then used to read the appropriate ranges for all utilities into the correct place in the translation worksheet.

There are two different types of utilities, direct Western customers and indirect Western customers. Information for the direct Western customers was read in directly, while that for the indirect customers was calculated by disaggregating wholesale values. This last task was accomplished by including each utility's share of the wholesale customer's entire level of sales and revenue in the transition variables. The formulas that created the cooked data included these variables.

Once the appropriate data are copied from the END_USE and END_USER worksheets, two cells need to be changed. Cells A2 and A3 must contain the alternative of interest. Call A2 must contain 'ALTXX' and cell A3 must contain XX, where XX represents the alternative of interest. These two cells feed into both input and output macros, inputting

the appropriate ranges from finance worksheets and writing out the appropriate file names for the output files. The two macros can then be run to input the finance data and write out the output files. The naming conventions for output files are as follows. The first two positions of REMI input file names contain information on the marketing alternative, and the third character shows the number of the region under consideration. For example, 3A6VAR.PRN is the name of the REMI input file for revenue and price changes for subregion 6 (Wyoming Metropolitan) for marketing alternative 3A; REMI_3A.PRN contains all REMI inputs for alternative 3A for hard-copy printout; EXPEN_3A contains the total revenue numbers for the distributional analysis; and AG_OUT3A.PRN and AG_OUT3A.WK3 are the files for hard copy and input into agricultural analysis for alternative 3A, respectively.

A check on the translation worksheet was created in the top five rows of the input worksheet, REG_TRANS.WK3. This worksheet uses 1991 EIA Form 861 data and the vector dot products of the appropriate input columns and translation matrix, and it compares the values for the same variables calculated in the ALT1A worksheet.